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(21) International Application Number: PCT/HU96/00041 (22) International Filing Date: 26 July 1996 (26.07.96) (30) Priority Data: P 95 02426 17 August 1995 (17.08.95) HU (71) Applicant (for all designated States except US): CHINOIN GYÓGYSZER ÉS VEGYÉSZETI [HU/HU]; Termékek Gyára Rt., Tó u. 1-5, H-1045 Budapest (HU). (72) Inventors; and (75) Inventors/Applicants (for US only): KÁNAI, Károly [HU/HU]; Markó u. 7, H-1055 Budapest (HU). ERDŐ, Sándor [HU/HU]; Kleh I. u. 3/B, H-1126 Budapest (HU). SZAPPANOS, Andrea [HU/HU]; Üllő út 120-122, H-1101 Budapest (HU). BENCE, Judit [HU/HU]; Silvanus sétány 33, H-1031 Budapest (HU). HERMECZ, István [HU/HU]; Molnár u. 53, H-1056 Budapest (HU). SZVOBODA, Györgyné [HU/HU]; Váci u. 21, H-2120 Dunakeszi (HU). BÁTORI, Sándor [HU/HU]; Rákóczi út 268/A, H-1214 Budapest (HU). HÉJA, Gergely [HU/HU]; Násznagy u. 27, H-1131 Budapest (HU). BALOGH, Mária [HU/HU]; Barátság u. 21, H-2120 Dunakeszi (HU). HORVÁTH, Ágnes [HU/HU]; Budenz u. 30/a, H-1021 Budapest (HU). SIPOS, Judit [HU/HU]; Sáfrány u. 40, H-1116 Budapest		(HU). BARTÁNE, Bodor, Veronika [HU/HU]; Nyár u. 33, H-1043 Budapest (HU). PÁRKÁNY, Zsolt [HU/HU]; Balázs B. u. 32/b, H-1094 Budapest (HU). LAKICS, Viktor [HU/HU]; Borsó u. 62, H-1173 Budapest (HU). MOLNÁR, Péter [HU/HU]; Rigómező u. 1, H-2143 Kistarcsa (HU). (74) Common Representative: CHINOIN GYÓGYSZER ÉS VEGYÉSZETI; Termékek Gyára Rt., Iparjogi Osztály, Tó u. 1-5, H-1045 Budapest (HU). (81) Designated States: AL, AM, AT, AU, AZ, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, US, UZ, VN, ARIPO patent (KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i> <i>Before the expiration of the time limit for amending the</i> <i>claims and to be republished in the event of the receipt of</i> <i>amendments.</i>
(54) Title: PROLYLENDOPEPTIDASE INHIBITORS (57) Abstract The present invention relates to new prolylendopeptidase inhibitors of general formula (I).		

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PROLYL ENDOPEPTIDASE INHIBITORS

5 The present invention relates to new compounds of the general Formula (I), to pharmaceutical compositions containing them, and to the process for the preparation of these compounds. A further aspect of our present invention is the use of the new compounds of the general formula I for the treatment of CNS diseases by inhibition of certain enzymes described later on on this page.

10

Because of the incidence and social consequences of diseases of the central nervous system accompanied with amnesia, dementia and the progressive decline of cognitive and intellectual functioning for example Alzheimer disease, AIDS dementia, senile dementias of various origin (hypoxia, ischaemia) there are
15 significant demands for new pharmaceuticals for treating and preventing the diseases mentioned above.

Prolyl endopeptidase PE or PEP is a post-proline cleaving enzyme (PPCE). It is widespread in mammalian species and can be found in various organs of the body.
20 The level of the enzyme is the highest in the brain, testis and skeletal muscle (Yoshimoto T., Ogita K., Walter, R., Koida M. and Tsuru D.: Biochim. Biophys. Acta, 569, (1979), 184-192).

PEP has some important role in memory process due to the fact that its substrates are
25 biologically active neuropeptides (substance P, thyrotropin-releasing hormone, Arg⁸-Vasopressin). These neuropeptides exert characteristic pharmacological effects on the central nervous system: they are capable of changing the performance of animals and humans in learning and memory tasks (Toide K., Iwamoto Z., Fujiwara T., and Abe H.: J. Pharm. Exp. Therapeutics, 274, (1995), 1370-1378; Riedel W. and Jolles
30 J., Drugs & Aging, 8, (1996), 245-274). The neuropeptide substance P prevents β -amyloid-induced neuronal loss and expression of Alz-50 proteins in cerebral cortex (Kowall N., Beal M.F., Busciglio J., and Duffy L.K.: Proc. Natl. Acad. Sci., 88, (1991), 7247-7251). In brains of patients with Alzheimer's disease, it is well known that the cerebral ACh content decreased and the cerebral function suffers severe

5 damage (O'Leary R. and O'Connor B.: J. Neurochem., 65, (1995), 953-963). A PEP inhibitor through the increasing the level of TRH could induce ACh release in the brain which should result in a better cognitive performance. It can be supposed that a highly specific PEP inhibitor could prove to be useful in the treatment of diseases of central nervous system in neurodegenerative illnesses.

The new PEP inhibitor as a new drug would be a

10 1. nootropic drug having memory enhancing and anti-amnestic effect and could be used in treatment of age-related cognitive decline;

2. neuropotective agent useful in therapy of

a., acute events (ischemia/hypoxia)

b., progressive neurodegenerative disorders

15 -Alzheimer's disease

-AIDS dementia

-Huntington's disease

20 Senile dementia and Alzheimer's disease become serious and fastly outgrowing problem of the aging population and a PEP inhibitor could be useful for the general treatment of the above mentioned serious diseases.

We set ourselves the task of preparing new PEP-inhibitors displaying advantageous characteristics which could serve as active ingredients of new drugs. By advantages

25 we mean over a strong PEP - inhibitory effect, selectivity, easily transfer through the blood-brain barrier, a long half-life, good oral resorption, enhanced chemical and biological stability and advantageous therapeutical profile including lower toxicity and low probability of side effects.

During the synthesis and biological examination of numerous new compounds we

30 found that new compounds of the general formula (I) wherein A means an onefold or manifold substituted or unsubstituted organic cyclic group containing one nitrogen atom with one free valency and optionally one or more further heteroatom selected from a group consisting of nitrogen atom, sulfuratom or oxigenatom, especially a group having the general formula (1), (1a), (2), (2a), (3), (3a), (4), (5), (6), (7), (8),

35 (9), (10), (11a), (11b), (12), (12a), (12b), (13), (13a), (14), (15), (16), (17), (18), (19), (19a), (20), (20a), (21), (22), (23), (23a), (23b), (24), (25), (25a), (26), (27), (28), (28a), (28b), (29), (29a), (30), (31), (32), (32a), (33), (34), (35), (36) - wherein

R means hydrogenatom alkyl group of 1-4 carbon atoms or aryl or aralkyl group of 6-12 carbon atoms;

5 R¹, R², R³ and R⁴ mean independently from each other hydrogen atom, halogen atom, hydroxyl group, straight chain or branched chain alkyl or alkenyl- or alkynyl or alkoxy- or alkenyloxy- or alkynyloxy groups containing 1-6 carbon atoms, nitro-group, amino group, monoalkylamino or monoacylamino group of 1-12 carbon atoms, dialkylamino- or diacylamino group of 2-24 carbon atoms - where the acyl
10 group is an alkyl, aralkyl, cycloalkyl or aryl type -, cyano group, mercapto group, carboxyl group, esterified carboxyl group of 2-7 carbon atoms, hydroxyalkyl group of 1-6 carbon atoms, acyl group of 1-7 carbon atoms, acyloxy group of 1-7 carbon atoms, phenyl or benzyl group, anilino group, benzoyl group, phenoxy group, benzyloxy group, isocyanato group, isothiocyanato group, alkylthio group of 1-6
15 carbon atoms, sulfamino or sulfamoyl group, thiocyanato or cyanato group;

R⁵ and R⁶ mean independently from each other hydrogen atom, hydroxyl group phenyl group or alkyl group of 1- 4 carbon atoms or R⁵ and R⁶ together mean oxo group;

R⁷ means alkyl group of 1-6 carbon atoms;

20 R⁸ means hydrogen atom or alkyl group of 1-6 carbon atoms or aralkyl group of 7-10 carbon atoms;

the dotted line means an optional chemical bond;

n is zero 1, 2 or 3;

X means-CH₂-group, -NH-group, carbon atom, hydrogen atom,
25 oxygen atom or amino group; or

R⁹
|

A means an R' - Y - N = group or R'-Y-N- group - wherein R' means alkyl group of 1-6 carbon atoms, aralkyl group of 7-10 carbon atoms, diphenylmethyl group, alkoxy group, arylalkyloxy group of 7-10 carbon atoms, or phenyl- or phenoxy or
30 phenylalkyl group containing 7-10 carbon atoms or phenylalkyloxy group containing 7-10 carbon atoms optionally substituted with halogen atoms or alkyl groups of 1-4 carbon atoms or nitro groups; Y means chemical bond or oxo-, sulfonyl- or sulfinyl group, R⁹ means hydrogen atom or alkyl group of 1-4 carbon atoms; - with the proviso that in the case of formulas (20) and (33) X cannot mean - CH₂- group, -
35 NH- group, oxygen atom or sulfur atom and in the case of formulas (30) and (31) X cannot mean - CH₂- group, oxygen atom or sulfur atom or amino group;

B means $-(CH_2)_m - \overset{\overset{O}{\parallel}}{C} -$ group - wherein m is an integer of 1 to 21; or

5 $-O-(CH_2)_p - \overset{\overset{O}{\parallel}}{C} -$ group wherein p is an integer of 1 to 3; or

$$\begin{array}{c} R^{12} \left[\begin{array}{c} R^{13} \\ \vdots \\ R^{10} \end{array} \right] \begin{array}{c} R^{14} \\ \vdots \\ R^{11} \end{array} \\ \vdots \quad \vdots \quad \vdots \\ -C- \quad -C- \quad -C- \quad \overset{\overset{O}{\parallel}}{C}- \\ \vdots \quad \vdots \quad \vdots \quad \vdots \\ R^9 \quad R^{10} \quad R^{11} \quad O \end{array}$$
 group - wherein $R^9, R^{10}, R^{11}, R^{12}, R^{13}$ and R^{14} mean

10 independently from each other hydrogen alkyl or alkoxy group of 1-6 carbonatoms, halogen, amino group optionally substituted with one or two alkyl group of 1-6 carbonatoms; or

phenyl, phenoxy, aryl-alkyl group of 7-12 carbonatoms or aryl-alkoxy group of 7-12 carbonatoms each of them optionally containing 1, 2 or 3 same or different

15 substituents identical to R^1, R^2, R^3 or R^4 ; or

two of $R^9, R^{10}, R^{11}, R^{12}, R^{13}$ and R^{14} mean together an oxo or epoxy group or further chemical bond or four of them mean together two further chemical bonds and the remaining groups stand for hydrogen atoms; or

20 $R^9, R^{10}, R^{11}, R^{12}, R^{13}$ and R^{14} mean together with the chain carbonatoms a saturated or unsaturated homocycle containing 3-8 carbon atoms or a saturated or unsaturated heterocycle containing 2-7 carbon atoms and a nitrogen or sulfur or oxygen atom, to which optionally an aromatic ring of 6-10 carbon atoms is condensed; and w is zero or 1;

C means prolyl group or one of the groups of formula (37), (38), (39), (40) or (41)

25 - where n is zero or 1 or 2, Hlg means fluorine, chlorine, bromine, or iodine atom;

R^5 and R^6 mean independently from each other hydrogen atom, hydroxyl group, phenyl group or alkyl group of 1-4 carbonatoms or R^5 and R^6 together mean oxo-group;

R^{16} means an alkoxy group of 1-4 carbon atoms, or $-NH-CH_2-CN$ group, or -

30 $NH-CH_2-CO_2R^7$ group - where R^7 is defined as above; or

D or L structural unit; or one of the group of the formula (42) or (43) or (43a)

- where the dotted line means a chemical bond optionally present-, s is 1, 2 or 3 - or

a group of the formula (44) -wherein R^{15} means hydrogen atom, alkyl group of 1-6 carbon atoms, phenyl or naphthyl group; or

35 a group of the formula (45) - wherein Z means NH - group, oxygen atom or sulfur atom;

D means a covalent chemical bond or prolyl- or thioprolyl group, or one of groups of formula (37) or (38), (39), (40) or (41);

5 L means pyrrolidino- or 2- cyanopyrrolidino, thiazolidino or 2-cyano-thiazolidino or piperidino group optionally substituted with one halogen atom or geminally with two halogen atoms; or

a group of the formula (46) - where R^{17} means hydrogen atom or cyano group, n is 0, 1 or 2 ; or

10 a group of the formula (47) or (48) or (49); -

and optical , cis-trans, geometric isomers , epimers, tautomers, salts, prodrugs and human and mammalian metabolites of them have significant prolylendopeptidase inhibiting effect and they show one or more advantages mentioned above. Some preferred groups of compounds of the general formula (I) are as defined claimed in

15 claims 3, 8 and 9.

The meaning of „onefold or manifold substituted or unsubstituted organic cyclic group containing one nitrogen atom with one free valency and optionally one or more further heteroatom(s) selected from a group consisting of nitrogen atom, sulfur atom or oxygen atom” in case of A covers all known monocyclic or polycyclic group satisfying above definition.

20

In case of a polycyclic group the rings may be condensed and/or may be in spirocyclic position. Some representatives of above cyclic groups are depicted in formulas, (1), (1a), (2), (2a), (3), (3a), (4), (5), (6), (7), (8), (9), (10), (11a), (11b), (12), (12a), (12b), (13), (13a), (14), (15), (16), (17), (18), (19), (19a), (20), (20a),

25 (21), (22), (23), (23a), (23b), (24), (25), (25a), (26), (27), (28), (28a), (28b), (29), (29a), (30), (31), (32), (32a), (33), (34), (35), (36).

In the definitions of general formula (I) „alkyl group of 1-6 carbonatoms” means a straight chain or branched alkyl group having 1 to 6 carbonatoms such as methyl, ethyl, propyl, butyl, isobutyl, sec-butyl, tert-butyl, pentyl, neopentyl and hexyl. The

30 „aryl group of 6-10 carbonatoms” means for example phenyl, tolyl or naphthyl groups.

The „aralkyl group of 6-10 carbonatoms” means for example benzyl-, 1-phenyl-ethyl-, 2-phenyl, ethyl-, 1-phenyl-propyl-groups. The alkenyl group of 1-6 carbon atoms means a straight chain or branched alkenyl group such as vinyl, allyl,

35 methacryl, crotyl, 3-butenyl, 2-pentenyl-, 4-pentenyl-, 2-hexenyl-, 5-hexenyl. The „alkynyl group of 1-6 carbon atoms” means a straight-chain or branched alkynyl

group such as ethynyl, propargyl, 2-butylnyl-, 3-butylnyl, 2-pentylnyl, 4-pentylnyl, 2-hexynyl 5-hexynyl 4-methyl-2-hexynyl.

- 5 The cycloalkyl part of the „acyl group of 1-12 carbonatoms” means for example cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, cycloheptyl or cyclooctyl group. These definitions may be used in case of alkyloxy, alkenyloxy-, alkynyloxy, aryloxy, aralkyloxy, phenylalkyloxy or alkylamino or acylamino groups.

- 10 We have examined the PEP - inhibitory activity and the biological stability of the compounds characterised by formula (I) applying the following methods:

PEP activity measurement on rat brain extract:

- 15 After removal of the cerebellum whole brain of male (Sprague-Dawley, 180-200g) rats was homogenized in a double volume of 0.1 M Tris-HCl, 1mM EDTA buffer, pH=7.5 (PEP buffer). The homogenate was centrifuged for 30 min. at 4°C at 40000 g and the supernatant, containing the enzyme, was collected. The pellet was resuspended in the same volume of buffer as in the first case and centrifuged again
- 20 under the same conditions. The two supernatants were pooled and stored in 1ml aliquots at -70°C (for at least 3 months). The supernatant was thawed just before activity measurement and diluted in a 1:15 ratio with PEP buffer. The enzyme activity was measured by using fluorimetric method described by J. R. Atack et al. (Eur J. Pharmacol., 205, (1991), 157-163). Enzyme reaction was performed at room
- 25 temperature for 15 minutes in the presence of 62.5 µM Z-glycyl-prolyl-7-amino-4-methyl-coumarin (Bachem Biochem.) as a highly specific synthetic substrate of the PEP. The inhibitory effect of compounds was tested under the same conditions in the presence of 100 to 0.001nM compound. The formation of 7-amino-4-methyl-coumarin was detected spectrofluorometrically at 370 nm excitation and 440 nm
- 30 emission wavelength. The 50% inhibition concentration of the compounds (IC₅₀) were calculated by curve fitting of the % inhibition of the enzyme versus inhibitor concentration (M) using Hill-equation. IC₅₀ values of the compounds of the general formula (I) are in the range of 100nM - 1pM.

Pig brain PEP activity measurement

5 Purified pig brain prolyl endopeptidase was a kindly gift of László Polgár (Enzymology Institute of the Hungarian Academy of Sciences). Enzyme solution was diluted in the reaction mixture 400000 times. Measurements were performed under the same conditions as in the case of the in vitro measurements on rat brain preparation. The compounds of the general Formula I were shown to be also active
10 on pig brain PEP activity.

In vitro metabolism studies

The biological stability of prolyl endopeptidase inhibitors was studied in mouse , rat
15 and human (preparation of the Central Chemistry Institute of The Hungarian Academy of Sciences) liver microsomal preparation. Mouse and rat livers were pooled and homogenized in 4-fold volume Tris-HCl buffer (pH 7.4) containing 1.15% KCl and 1mM EDTA. The homogenates were centrifuged for 30 minutes at 10000 g , the supernatants were further ultracentrifuged for 1 hour at 105000g.
20 Pellets were rehomogenized and ultracentrifugation was repeated. The pellets were re-homogenized again and were diluted with buffer to a final volume of 0.5 g liver/ml. Samples were frozen in 2ml aliquots at -80 °C. Preparations were characterized for cytochrome P450 isoenzyme activities.

New inhibitors of the general formula (I) were tested under the following conditions:
25 Reaction mixture contained 2mg of liver microsomal protein, 0.1M Tris-HCl buffer (pH=7.4), 2mM NADP, 20mM glucose-6-phosphate disodium salt, 10 mM MgCl₂ 5 U glucose-6-phosphate dehydrogenase and 50 µM PEP inhibitors in a final volume of 1.5 ml. After 0, 10, 20, 40 min incubation times, reaction was terminated by addition of acetonitrile. Samples were centrifuged at 3000 rpm for 10 minutes. The
30 supernatant was analyzed by HPLC (Supelcosil C18). The unchanged substrate amount was determined and half-life of compounds were calculated.

Some compounds of the general formula I had half-life on human liver microsomes of more than 7 hours. Such good biological stability is in favour of an long lasting
35 effect in vivo and is an advantage over other peptidic-type PEP-inhibitors which are known to be biologically unstable.

The published European Patent Application No 0 232 849 A2 describes numerous PEP-inhibitor including SUAM-1221 (N-[N-(γ -phenyl)butyryl-L-prolyl]pyrrolidine).

- 5 The compounds of the general formula (I) exert high inhibition activity on prolyl endopeptidase and it is greater than that of above reference compound SUAM-1221 measured in our above described test-system:

	Compounds	IC ₅₀ (M) rat brain extract
10	Example 123	$2,78 \cdot 10^{-10}$
	Example 31	$3,60 \cdot 10^{-10}$
	Example 171	$4,51 \cdot 10^{-10}$
	SUAM-1221	$3,12 \cdot 10^{-8}$

- 15 The preparation of compounds of the general formula (I) is carried out by methods well known from the literature or by obvious chemical equivalents thereof relating to the synthesis of peptide type substances.

- The A and B units of compounds of the general formula A - B - C - D - L (I) - where the meanings of A, B, C, D, and L are as described above - are coupled by
20 the reaction of the appropriate acid anhydride or other activated acid derivative and an amine, yielding compounds of the general formula (II) - where the meanings of A and B are as described above. The coupling of units C and D happens likewise by coupling the appropriate activated acid derivative e.g. acid anhydride and an amine. The coupling of units CD and L to yield compounds of the general
25 formula (III) - where the meanings of CD and L are as described above - is carried out by reacting the appropriate mixed anhydride and amine resp. ester and metallo-organic compound.

- The starting compounds corresponding to units A, B, C, D, and L are commercially available or readily producible by known transformation of them or as described in
30 Chem Pharm. Bulletin 41 (9) p 1583-1588 (1993.)

- We have prepared the compounds of general formula (I) by reacting activated derivatives of compounds of the general formula (II) with compounds of the general formula (III) under conditions of amide coupling usual in peptide chemistry. The activated derivatives of compounds having general formula (II) could be e.g. acid
35 chlorides, which can be synthesized by applying halogenating agents (e.g. thionyl chloride). Active esters can be produced by 1-hydroxyl-benzotriazol in the presence

of N,N'-dicyclohexylcarbodiimid (Chem. Ber. 103, 788/1970/). Mixed anhydrides can be produced by - ester of chlorformic acid or by pivaloyl chloride (Methoden der
5 Organischen Chemie (Houben-Weyl) Band XV/2 Synthese von Peptiden, Georg Thieme Verlag, Stuttgart, 1974).

The coupling reaction can favourably be carried out in organic solvent preferably (at a temperature between - 25°C and the boiling point of the reaction mixture). Use of acid binding agents e.g. organic amines is favourable during the reaction.

10

The compounds of the general formula (I), can be purified, if appropriate, by a conventional purification technique, the isomers of which are separated, if desired, by a conventional separation technique and which are converted, if necessary, to their addition salts with a pharmaceutically acceptable acid.

15

Pharmaceutically acceptable acids may be for example hydrochloric, sulfuric, tartaric, fumaric methansulfonic acid and the like.

Another subject of the present invention is pharmaceutical compositions containing,
20 as active principle, at least one compound of general formula (I) or one of its addition salts with a pharmacologically acceptable acid, alone or in combination with one or more inert and nontoxic excipients or vehicles.

Mention may more particularly be made, among pharmaceutical compositions according to the invention, of those which are suitable for oral, parenteral rectal or
25 nasal administration, simple or sugar-coated tablets, sublingual tablets, injectable compositions, infusions, packets, gelatin capsules, suppositories, creams, ointments, dermal gels, and the like.

The dose varies according to the age and weight of the patient, the nature and the severity of the ailment and on the administration route.

30 The latter can be oral, nasal, rectal or parenteral. The unit dose generally varies between 0,1 and 50 mg/body weight kg for a treatment taken 1 to 3 times per 24 hours.

The invention will be further clarified by the following, tabular, non-limiting examples in greater detail and by a detailed process description in case of the
35 example 4. Other embodiments of the invention will be apparent to the person skilled in the art from a consideration of this specification or practice of the invention disclosed herein.

Examples

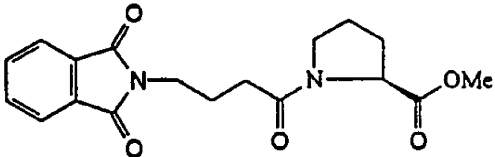
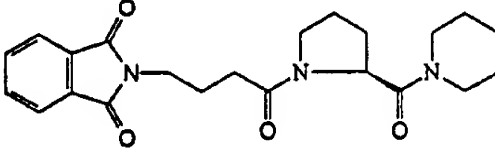
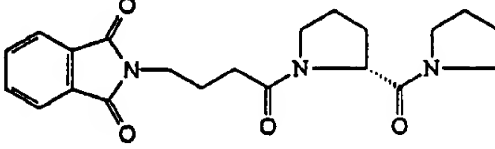
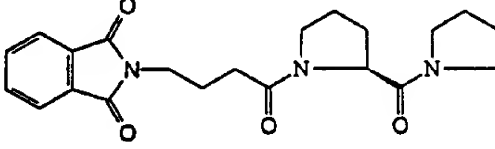
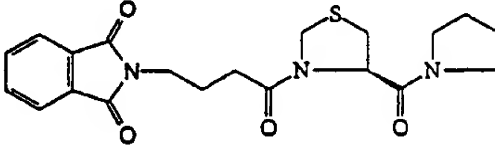
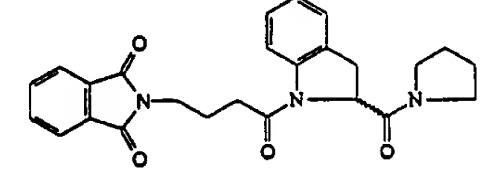
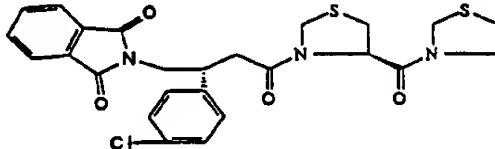
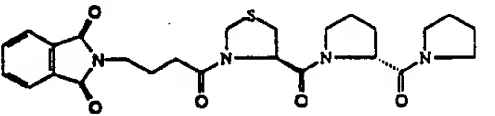
5 Description of the preparation of compound depicted in Example 4 (Table 1)

10 To a solution prepared by dissolving 1,17 g (5,0 mM) 4-phthalimido-butyric acid and 0,56 g (5,5 mM) triethylamin in 20 ml chloroform 0,61 g (5,0 mM) pivaloylchlorid were dropped at - 15 °C under stirring. The reaction mixture was stirred for 1 hour at the above temperature and then a solution prepared by dissolving 1,03 g (5,0 mM) L-prolyl-pyrrolidin-hydrochloric acid salt in a mixture of 5 ml chloroform and 1,5 ml (1,1 g, 11,0 mM) triethylamine were dropwise added to it. Reaction mixture was stirred at room temperature for 4 hours, then it was washed successively with water, 30 % cc. citric acid solution, saturated aqueous sodium bicarbonate solution, water and with saturated sodium chloride solution. The organic phase was dried on calcinated magnesium sulfate and it was evaporated. Crystallisation of the residue from a mixture of 5 ml chloroform and 10 ml petrolether yielded 1,1 g (53 %) N-(4-phthalimido-butanoyl)-L-prolyl-pyrrolidin which melted at 148-149 °C. The compounds of the general formula I were synthesised by the method as explained above starting from the corresponding compounds having general Formulas (II) and (III).

15 20

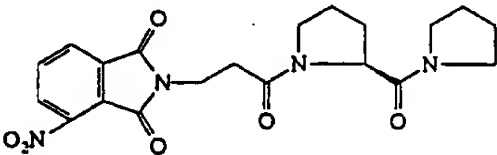
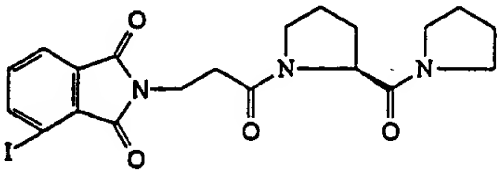
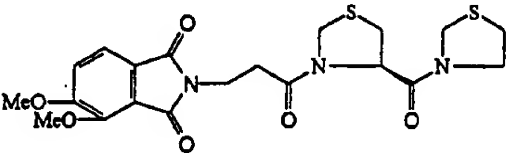
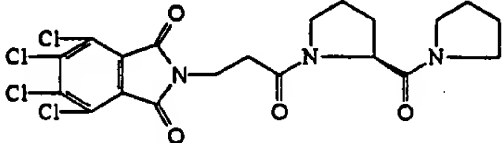
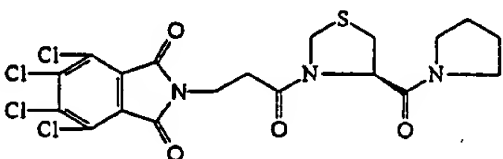
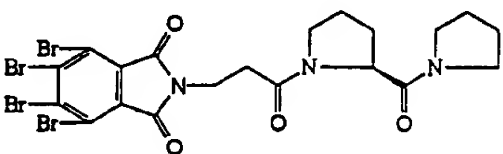
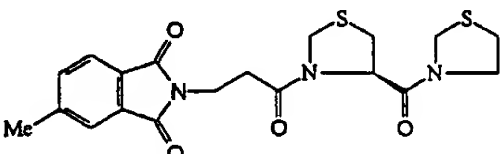
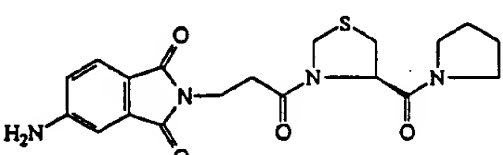
Structures and the physical constants of several novel compounds of the general Formula (I) are listed in Table 1.

Table 1

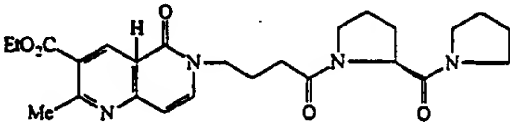
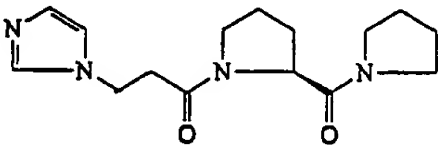
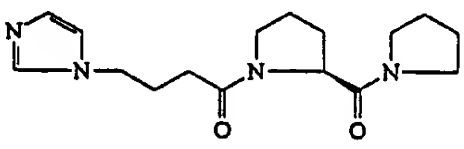
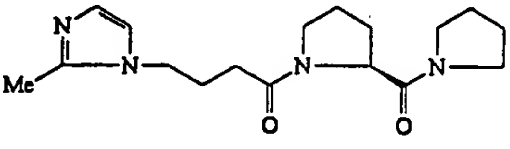
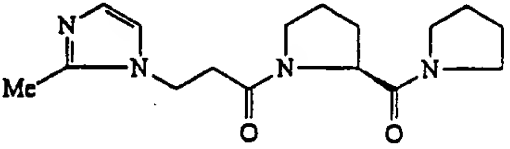
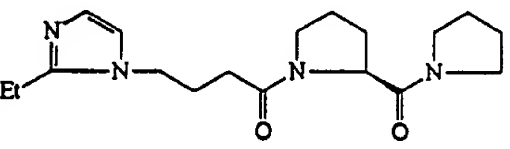
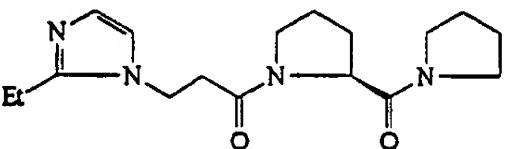
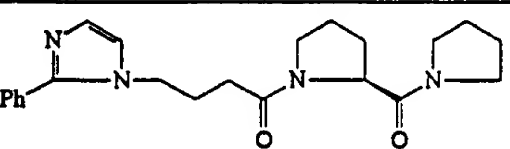
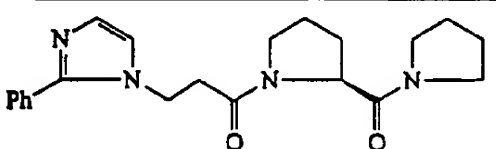
5	No. of examp- les	Structural formula of compounds	Melting point (°C)	Retention factor
10	1		99-100	
15	2		oil	0.31 ^A
20	3		146-147	
25	4		148-149	
30	5		oil	0.28 ^A
35	6		131-132	
35	7		206-207	
	8		oil	0.39 ^A

5	No. f examp- les	Structural formula of compounds	Melting point (°C)	Retention factor
	9		109-110	
10	10		168-169	
15	11		amorphous	0.38 ^A
20	12		186-187	
25	13		oil	0.24 ^A
30	14		oil	0.27 ^A
	15		oil	0.21 ^A
35	16		oil	0.22 ^A

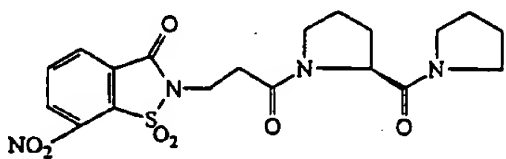
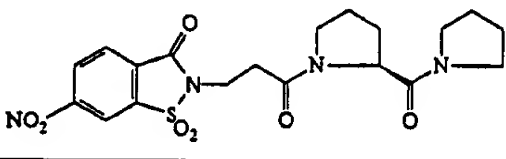
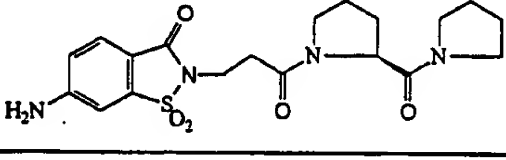
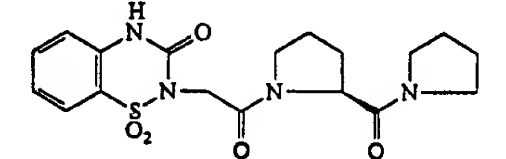
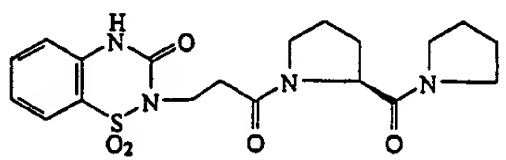
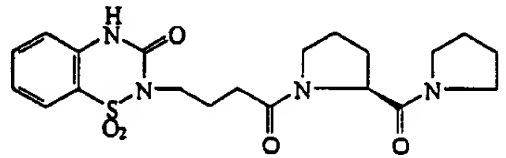
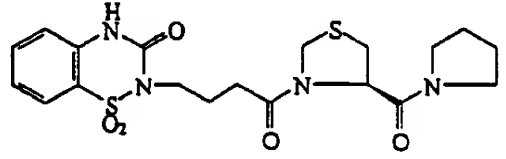
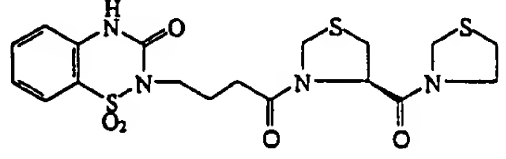
5	No. of examples	Structural formula of compounds	Melting point (°C)	Retention factor
17	17		oil	0.44 ^A
10	18		183-184	
15	19		207-208	
20	20		56-62	
20	21		138-140	
25	22		169-171	
30	23		136-137	
35	24		130-131	

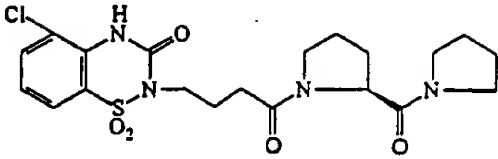
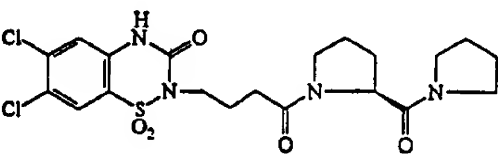
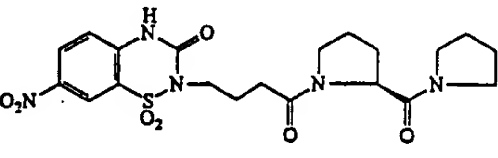
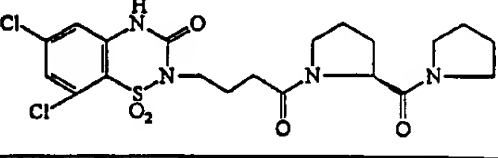
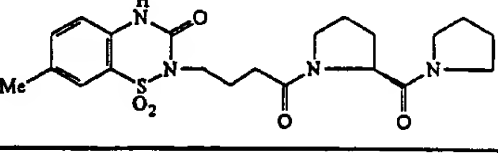
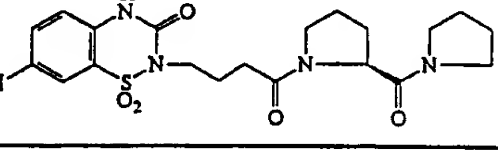
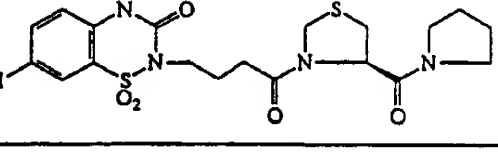
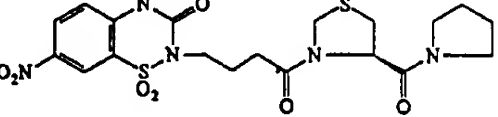
5	No. of examples	Structural formula of compounds	Melting point (°C)	Retention factor
	25		oil	0.32 ^A
10	26		oil	0.41 ^A
15	27		77-79	
20	28		220-222	
25	29		224-225	
30	30		245-248	
30	31		133-134	
35	32		220-222	

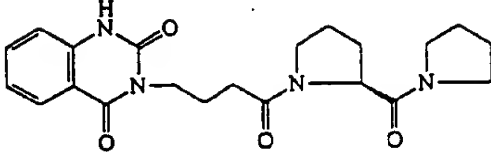
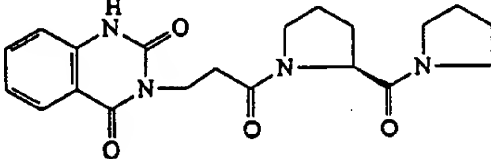
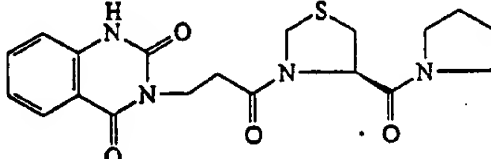
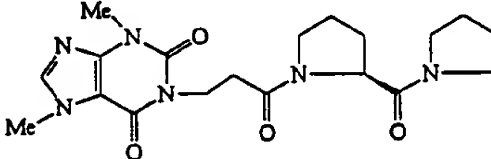
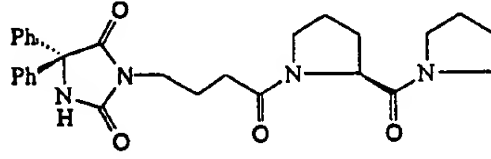
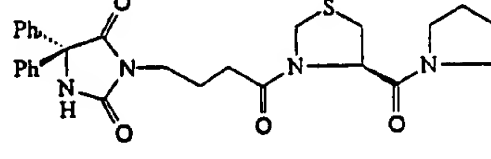
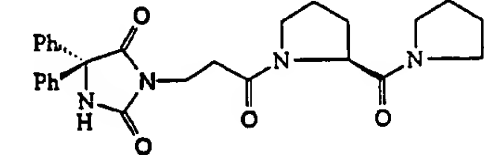
5	No. of exam- ples	Structural formula of compounds	Melting point (°C)	Retention factor
10	33		169-170	
15	34		138-139	
20	35		oil	0.35 ^A
25	36		68- 70	
30	37		107-109	
35	38		amorphous	0.55 ^B
35	39		105-112	

5	No. of examples	Structural formula of compounds	Melting point (°C)	Retention factor
	40		116-118	
10	41		oil	0.63 ^C
15	42		oil	0.22 ^D
	43		oil	.036 ^C
20	44		oil	0.50 ^C
25	45		oil	0.72 ^C
30	46		83- 86	
	47		oil	0.72 ^F
35	48		oil	0.70 ^F

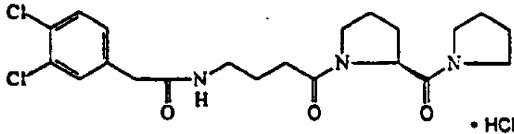
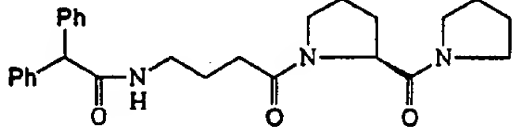
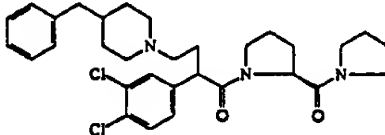
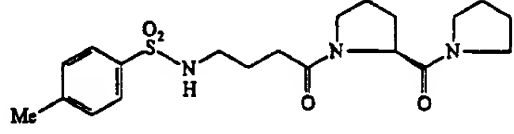
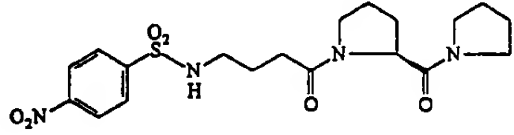
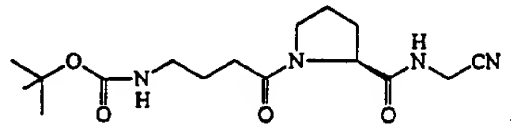
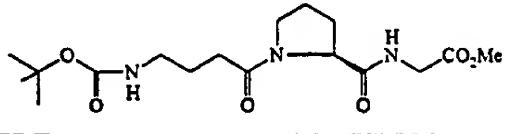
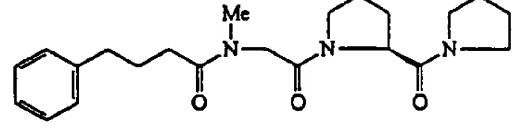
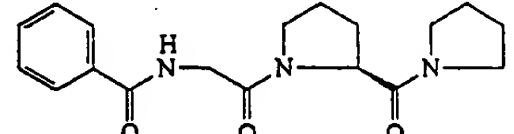
5	No. of examples	Structural formula of compounds	Melting point (°C)	Retention factor
	49		55- 60	
10	50		60- 62	
15	51		200-205	
20	52		85- 90	
25	53		122	
30	54		107-110	
	55		185-190	
35	56		87	

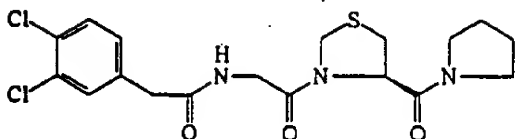
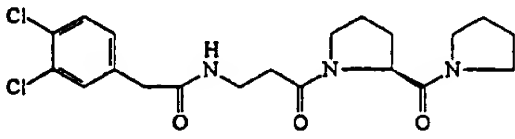
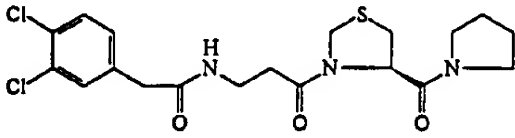
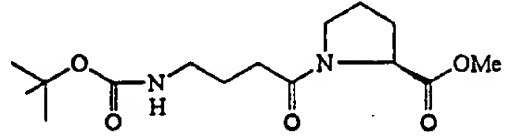
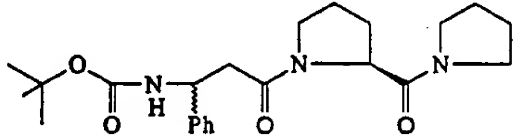
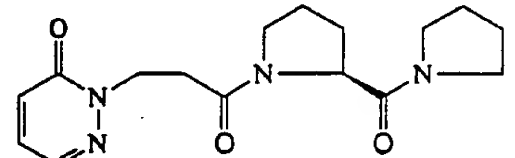
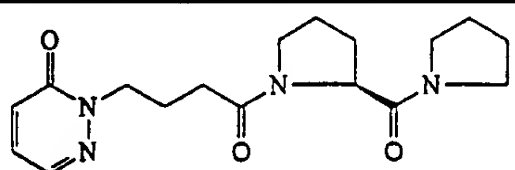
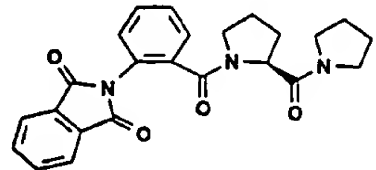
5	No. of examples	Structural formula of compounds	Melting point (°C)	Retention factor
	57		147	
10	58		95-100	
15	59		250	
20	60		155-157	
25	61		245	
	62		60	
30	63		116	
35	64		85	

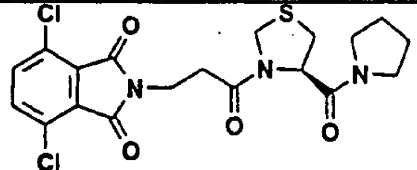
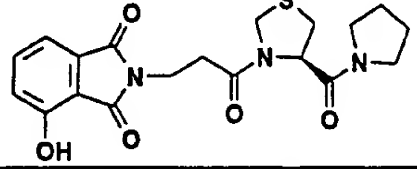
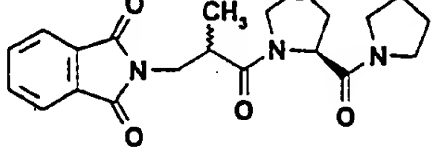
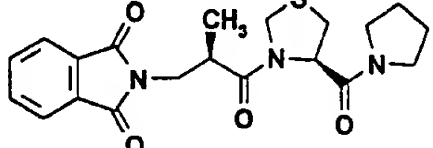
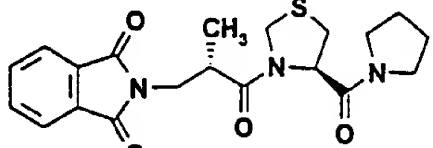
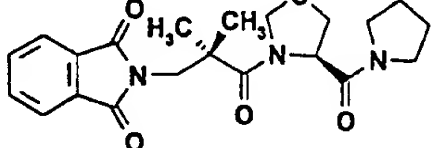
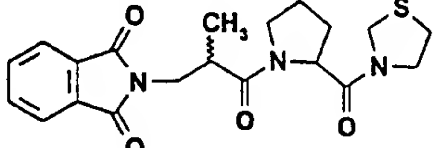
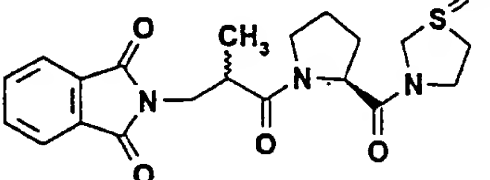
No. of examples	Structural formula of compounds	Melting point (°C)	Retention factor
5		85	
10		194	
15		95	
20		225-226	
25		120	
30		138	
35		117	
35		113-118	

5	No. of examp- les	Structural formula of compounds	Melting point (°C)	Retention factor
	73		oil	0.70 ^D
10	74		199-202	
15	75		197-198	
20	76		122-124	
25	77		230-232	
30	78		95- 97	
35	79		127-129	

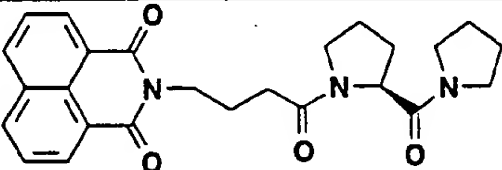
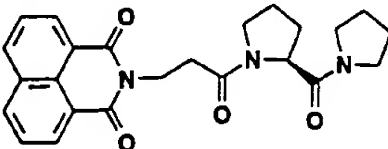
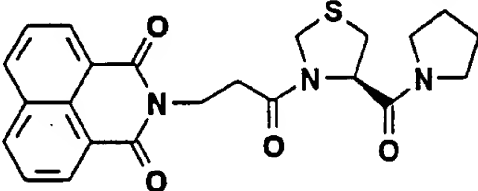
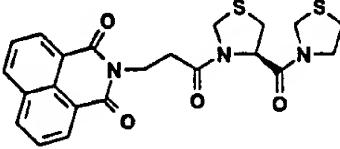
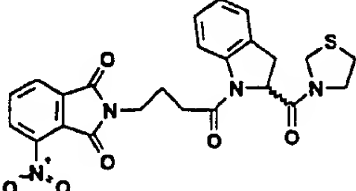
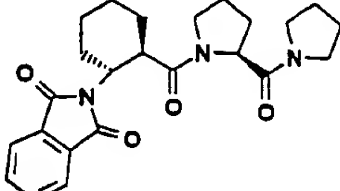
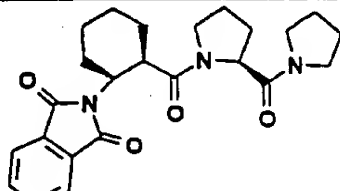
5	No. of examples	Structural formula of compounds	Melting point (°C)	Retention factor
	80		172-173	
10	81		204-205	
15	82		195-196	
20	83		oil	0.20 ^A
25	84		139-140	
	85		oil	0.19 ^A
30	86		oil	0.25 ^A
35	87		oil	0.40 ^B

	No. of examples	Structural formula of compounds	Melting point (°C)	Retention factor
5	88		oil	0.45 ^B
10	89		oil	0.45 ^B
15	90		oil	0.50 ^B
	91		oil	0.10 ^A
20	92		62-66	
25	93		oil	0.40 ^E
	94		oil	0.45 ^E
30	95		oil	0.34 ^A
35	96		158-160	

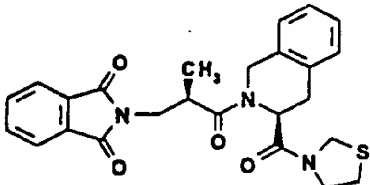
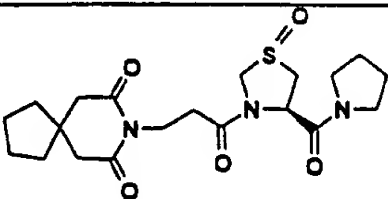
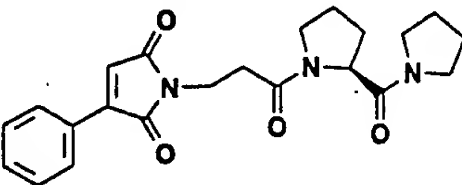
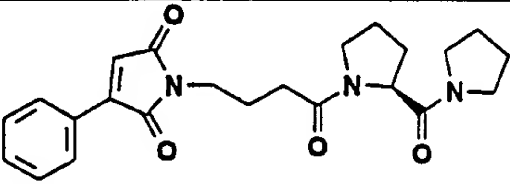
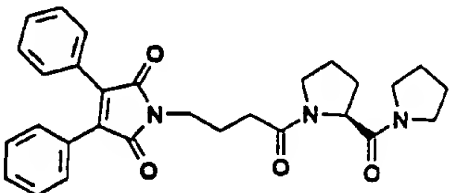
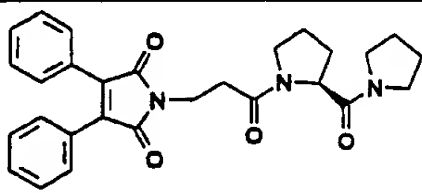
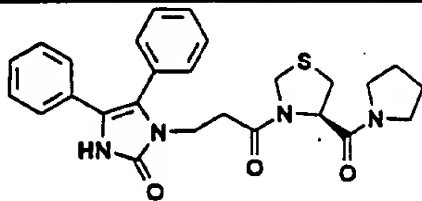
	No. of exam- ples	Structural formula of compounds	Melting point (°C)	Retention factor
5	97		163-164	
10	98		oil	0.50 ^B
15	99		oil	0.55 ^B
	100		oil	0.55 ^E
20	101		oil	0.24 ^A
25	102		oil	0.55 ^F
30	103		oil	0.60 ^F
35	104		70-74	

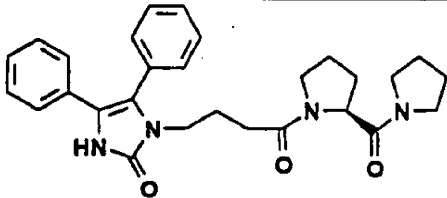
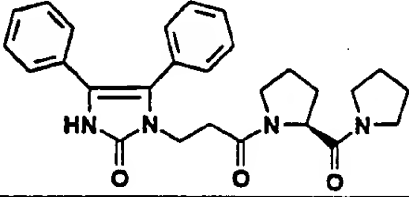
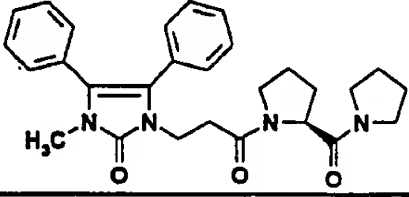
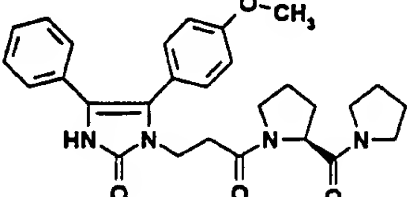
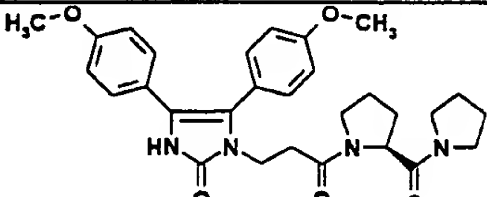
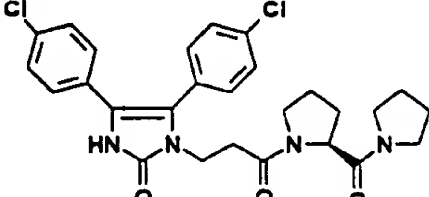
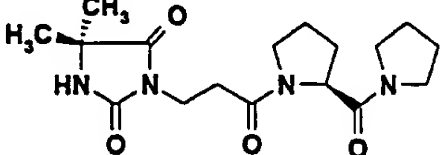
No. of examples	Structural formula of compounds	Melting point (°C)	Retention factor
5 105		188-189	
10 106		164-165	
15 107		amorphous	075 ^A
20 108 ^a		amorphous	0.26 ^L
25 109 ^a		142-143	0.18 ^L
30 110		163-164	
35 111		amorphous	0.34 ^A
35 112		amorphous	0.24 ^A

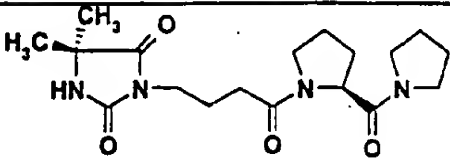
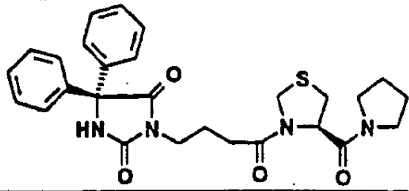
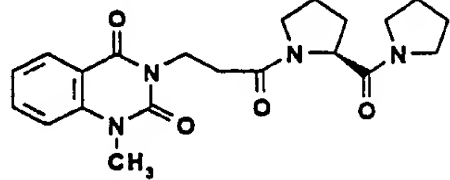
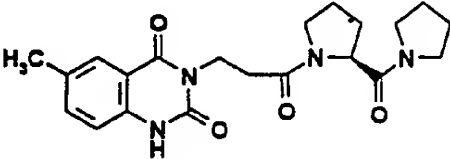
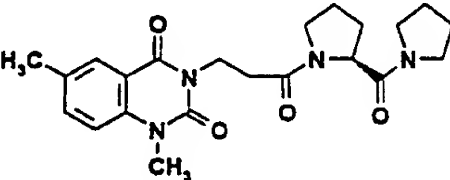
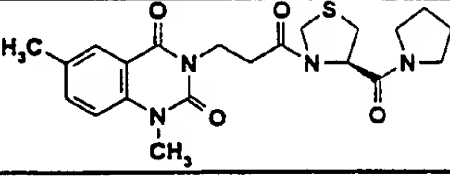
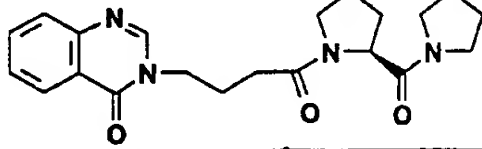
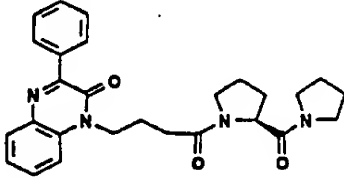
5	No. of examples	Structural formula of compounds	Melting point (°C)	Retention factor
	113		96-97	
10	114		74-75	
15	115		120-123	
20	116		195-197	
25	117		oil	0.35 ^A
30	118		oil	0.29 ^A
35	119		oil	0.22 ^A

5	No. of examp- les	Structural formula of compounds	Melting point (°C)	Retention factor
	120		58-60	
10	121		168-169	
15	122		105-109	
20	123		173-175	
25	124		gradual melting	0.32 ^A
30	125 ^b		188-189	
35	126 ^b		gradual melting	0.42 ^A

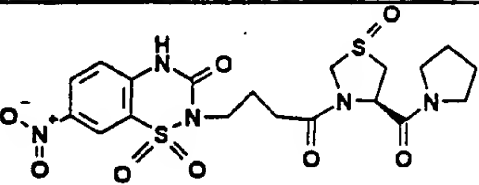
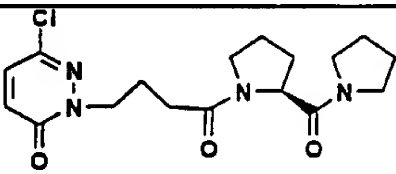
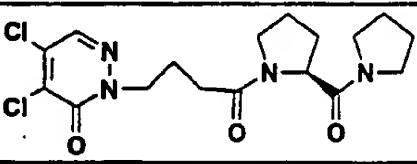
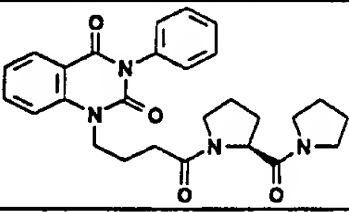
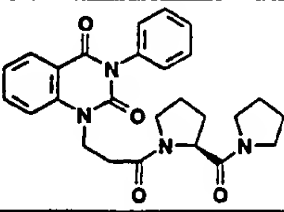
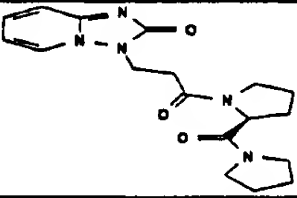
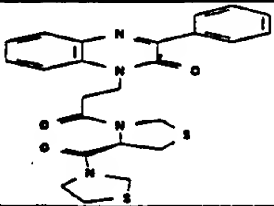
5	No. of examples	Structural formula of compounds	Melting point (°C)	Retention factor
	134		52	
10	135		166-168	
15	136		84-85	
20	137		103-105	
	138		241-242	
25	139		>200	
30	140 ^d		78-79	0.41 ^K

	No. of examp- les	Structural formula of compounds	Melting point (°C)	Retention factor
5	141 ^d		78-79	0.29 ^K
10	142		173-174	
15	143		68-72	
20	144		80-82	
25	145		72-75	
30	146		160-165	
35	147		260-262	

5	No. of examp- les	Structural formula of compounds	Melting point (°C)	Retention factor
	148		140-145	
10	149		268-270	
15	150		208-211	
20	151		236-240	
25	152		245-250	
30	153		274-280	
35	154		172-173	

5	No. of examples	Structural formula of compounds	Melting point (°C)	Retention factor
10	155		173	
	156		95-97	
15	157		105-107	
20	158		137-139	
	159		201-203	
25	160		167-169	
30	161		78	
	162		159-160	

5	No. of examp- les	Structural formula of compounds	Melting point (°C)	Retention factor
	163		221-226	
10	164		246-248	
15	165		95	
20	166		55-59	
25	167		99	
30	168		65	
35	169		110	
35	170		78	

5	No. of examples	Structural formula of compounds	Melting point (°C)	Retention factor
	171		181-184	
10	172		oil	0.52 ^F
15	173		114-115	0.66 ^F
20	174		94-96	
25	175		158-160	
	176		95-100	
30	177		217-222	

5	No. of examples	Structural formula of compounds	Melting point (°C)	Retention factor
10	178		144	
15	179		174-178	
20	180		95-105	
25	181		132-135	
30	182		237-238	
35	183		137-138	
	184		148-150	

5	No. of examples	Structural formula of compounds	Melting point (°C)	Retention factor
	185			0.26 ^A
10	186		191-192	
15	187		176-180	
20	188		143-145	
25	189		178-180	
30	190		181-183	
35	191		95-105	

a, b, c, d tentative assignment of epimers, maybe reverse

Abbreviations of eluents:

- A CM201 Chloroform: methanol = 20: 1
- B BM 41 Benzene methanol = 4: 1
- C CM 41 Chloroform methanol = 4: 1
- D DM101 Dichloromethane methanol = 10: 1
- E CM955 Chloroform methanol = 95: 5
- F CM 91 Chloroform methanol = 9: 1
- G DM 91 Dichloromethane methanol = 9: 1
- I HA 21 n-Hexane acetone = 2: 1
- J HA 31 n-Hexane acetone = 3: 1
- K CA 101 Chloroform acetone = 10: 1

Claims

5

- 1.) Compounds of the general formula (I) wherein A means an onefold of manifold substituted or unsubstituted organic cyclic group containing one nitrogen atom with one free valency and optionally one or more further heteroatom selected from a group consisting of nitrogen atom, sulfuratom or oxygenatom, especially groupg
- 10 having the general formula (1), (1a), (2), (2a), (3), (3a), (4), (5), (6), (7), (8), (9), (10), (11a), (11b), (12), (12a), (12b), (13), (13a), (14), (15), (16), (17), (18), (19), (19a), (20), (20a), (21), (22), (23), (23a), (23b), (24), (25), (25a), (26), (27), (28), (28a), (28b), (29), (29a), (30), (31), (32), (32a), (33), (34), (35), (36) - wherein R means hydrogenatom alkyl group of 1-4 carbon atoms or aryl or aralkyl group of
- 15 6-12 carbon atoms;
R¹, R², R³ and R⁴ mean independently from each other hydrogen atom, halogen atom, hydroxyl group, straight chain or branched chain alkyl or alkenyl- or alkynyl or alkoxy- or alkenyloxy- or alkynyloxy groups containing 1-6 carbon atoms, nitro-group, amino group, monoalkylamino or monoacylamino group of 1-12 carbon
- 20 atoms, dialkylamino- or diacylamino group of 2-24 carbon atoms - where the acyl group is an alkyl, aralkyl, cycloalkyl or aryl type -, cyano group, mercapto group, carboxyl group, esterified carboxyl group of 2-7 carbon atoms, hydroxyalkyl group of 1-6 carbon atoms, acyl group of 1-7 carbon atoms, acyloxy group of 1-7 carbon atoms, phenyl or benzyl group, anilino group, benzoyl group, phenoxy group,
- 25 benzyloxy group, isocyanato group, isothiocyanato group, alkylthio group of 1-6 carbon atoms, sulfamino or sulfamoyl group, thiocyanato or cyanato group;
R⁵ and R⁶ mean independently from each other hydrogen atom, hydroxyl group phenyl group or alkyl group of 1- 4 carbon atoms or R⁵ and R⁶ together mean oxo group;
- 30 R⁷ means alkyl group of 1-6 carbon atoms;
R⁸ means hydrogen atom or alkyl group of 1-6 carbon atoms or aralkyl group of 7-10 carbon atoms;
the dotted line means an optional chemical bond;
n is zero 1, 2 or 3;
- 35 X means-CH₂-group, -NH-group, carbon atom, hydrogen atom, oxygen atom or amino group; or

5 A means an $R'-Y-N=$ group or $R'-Y-\overset{R^9}{N}-$ group - wherein R' means alkyl group of 1-6 carbon atoms, aralkyl group of 7-10 carbon atoms, diphenylmethyl group, alkoxy group, arylalkoxy group of 7-10 carbon atoms, or phenyl- or phenoxy or phenylalkyl group containing 7-10 carbon atoms or phenylalkoxy group containing 7-10 carbon atoms optionally substituted with halogen atoms or alkyl groups of 1-4 carbon atoms or nitro groups; Y means chemical bond or oxo-, sulfonyl- or sulfinyl group, R^9 means hydrogen atom or alkyl group of 1-4 carbon atoms; - with the proviso that in the case of formulas (20) and (33) X cannot mean $-CH_2-$ group, $-NH-$ group, oxygen atom or sulfur atom and in the case of formulas (30) and (31) X cannot mean $-CH_2-$ group, oxygen atom or sulfur atom or amino group;

15 B means $-(CH_2)_m-\overset{\text{O}}{\underset{\text{O}}{\text{C}}}-$ group - wherein m is an integer of 1 to 21; or

$-O-(CH_2)_p-\overset{\text{O}}{\underset{\text{O}}{\text{C}}}-$ group wherein p is an integer of 1 to 3; or

20 $-\overset{\text{R}^{12}}{\underset{\text{R}^9}{\text{C}}}-\left[\overset{\text{R}^{13}}{\underset{\text{R}^{10}}{\text{C}}}\right]_w-\overset{\text{R}^{14}}{\underset{\text{R}^{11}}{\text{C}}}-\overset{\text{O}}{\underset{\text{O}}{\text{C}}}-$ group - wherein $R^9, R^{10}, R^{11}, R^{12}, R^{13}$ and R^{14} mean

independently from each other hydrogen alkyl or alkoxy group of 1-6 carbonatoms, halogen, amino group optionally substituted with one or two alkyl group of 1-6 carbonatoms; or

25 phenyl, phenoxy, aryl-alkyl group of 7-12 carbonatoms or aryl-alkoxy group of 7-12 carbonatoms each of them optionally containing 1, 2 or 3 same or different substituents identical to R^1, R^2, R^3 or R^4 ; or

two of $R^9, R^{10}, R^{11}, R^{12}, R^{13}$ and R^{14} mean together an oxo or epoxy group or further chemical bond or four of them mean together two further chemical bonds and the remaining groups stand for hydrogen atoms; or

30 $R^9, R^{10}, R^{11}, R^{12}, R^{13}$ and R^{14} mean together with the chain carbonatoms a saturated or unsaturated homocycle containing 3-8 carbon atoms or a saturated or unsaturated heterocycle containing 2-7 carbon atoms and a nitrogen or sulfur or oxygen atom, to which optionally an aromatic ring of 6-10 carbon atoms is condensed; and w is zero or 1;

35 C means prolyl group or one of the groups of formula (37), (38), (39), (40) or (41) - where n is zero or 1 or 2, Hlg means fluorine, chlorine, bromine, or iodine atom;

- 5 R^5 and R^6 mean independently from each other hydrogen atom, hydroxyl group phenyl group or alkyl group of 1-4 carbon atoms or R^5 and R^6 together mean oxo-group;
- R^{16} means an alkoxy group of 1-4 carbon atoms, or -NH-CH₂-CN group. or -NH-CH₂-CO₂R⁷ group - where R⁷ is defined as above; or
- D or L structural unit; or one of the group of the formula (42) or (43) or (43a) - where the dotted line means a chemical bond optionally present-, s is 1, 2 or 3 - or
- 10 a group of the formula (44) -wherein R¹⁵ means hydrogen atom, alkyl group of 1-6 carbon atoms, phenyl or naphthyl group; or
- a group of the formula (45) - wherein Z means NH - group, oxygen atom or sulfur atom;
- D means a covalent chemical bond or prolyl- or thioprolyl group, or
- 15 one of groups of formula (37) or (38), (39), (40) or (41);
- L means pyrrolidino- or 2- cyanopyrrolidino, thiazolidino or 2-cyano-thiazolidino or piperidino group optionally substituted with one halogen atom or geminally with two halogen atoms; or
- a group of the formula (46) - where R¹⁷ means hydrogen atom or cyano group, n is
- 20 0, 1 or 2 ; or
- a group of the formula (47) or (48) or (49); -
- and optical , cis-trans, geometric isomers , epimers, tautomers, salts, prodrugs and human and mammalian metabolites of them.
- 25 2.) Compounds of the general formula (I),- wherein A means one of the groups having general formula (1), (1a), (2), (2a), (3), (3a), (4), (5), (6), (7), (8), (9), (10), (11a), (11b), (12), (12a), (12b), (13), (13a), (14), (15), (16), (17), (18), (19), (19a), (20), (20a), (21), (22), (23), (23a), (23b), (24), (25), (25a), (26), (27), (28), (28a), (28b), (29), (29a), (30), (31), (32), (32a), (33), (34), (35), (36) - wherein
- 30 R means hydrogenatom alkyl group of 1-4 carbon atoms or aryl or aralkyl group of 6-12 carbon atoms,
- R¹, R², R³ and R⁴ mean independently from each other hydrogen atom, halogen atom, hydroxyl group, straight chain or branched chain alkyl or alkenyl- or alkynyl or alkoxy- or alkenyloxy- or alkinyloxy groups containing 1-6 carbon atoms, nitro-
- 35 group, amino group, monoalkylamino or monoacylamino group of 1-12 carbon atoms ,dialkylamino- or diacylamino group of 2-24 carbon atoms - where the acyl group is an alkyl, aralkyl, cycloalkyl or aryl type -, cyano group, mercapto group,

carboxyl group, esterified carboxyl group of 2-7 carbon atoms, hydroxyalkyl group of 1-6 carbon atoms, acyl group of 1-7 carbon atoms, acyloxy group of 1-7 carbon atoms, phenyl or benzyl group, anilino group, benzoyl group, phenoxy group, benzyloxy group, isocyanato group, isothiocyanato group, alkylthio group of 1-6 carbon atoms, sulfamino or sulfamoyl group, thiocyanato or cyanato group;
 5 R^5 and R^6 mean independently from each other hydrogen atom, hydroxyl group, phenyl group or alkyl group of 1-4 carbon atoms or R^5 and R^6 together mean oxo group;
 10 group;

R^7 means alkyl group of 1-6 carbon atoms;

R^8 means hydrogen atom or alkyl group of 1-6 carbon atoms or aralkyl group of 7-10 carbon atoms;

the dotted line means an optional chemical bond;

15 n is zero, 1, 2 or 3;

X means $-CH_2-$ group, $-NH-$ group, carbon atom, hydrogen atom, oxygen atom or amino group; or

A means an $R'-Y-N=$ group or $R'-Y-N-$ group - wherein R' means alkyl group of 20 1-6 carbon atoms, aralkyl group of 7-10 carbon atoms, diphenylmethyl group, alkoxy group, arylalkyloxy group of 7-10 carbon atoms, or phenyl- or phenoxy or phenylalkyl group containing 7-10 carbon atoms or phenylalkyloxy group containing 7-10 carbon atoms optionally substituted with halogen atoms or alkyl groups of 1-4 carbon atoms or nitro groups; Y means chemical bond or oxo-, sulfonyl- or sulfinyl group, R^9 means hydrogen atom or alkyl group of 1-4 carbon atoms; - with the proviso that in the case of formulas (20) and (33) X cannot mean $-CH_2-$ group, $-NH-$ group, oxygen atom or sulfur atom and in the case of formulas (30) and (31) X cannot mean $-CH_2-$ group, oxygen atom or sulfur atom or amino group;

25 B means $-(CH_2)_m - \overset{\overset{R^9}{|}}{\underset{\underset{O}{||}}{C}} -$ group - wherein m is an integer of 1 to 21; or

30 $-O - (CH_2)_p - \overset{\overset{O}{|}}{\underset{\underset{O}{||}}{C}} -$ group wherein p is an integer of 1 to 3; or

35 $-\overset{\overset{R^{12}}{|}}{\underset{\underset{R^9}{|}}{C}} - \left[\overset{\overset{R^{13}}{|}}{\underset{\underset{R^{10}}{|}}{C}} \right]_w - \overset{\overset{R^{14}}{|}}{\underset{\underset{R^{11}}{|}}{C}} - \overset{\overset{O}{||}}{C} -$ group - wherein $R^9, R^{10}, R^{11}, R^{12}, R^{13}$ and R^{14} mean

independently from each other hydrogen alkyl or alkoxy group of 1-6 carbon atoms, halogen, amino group optionally substituted with one or two alkyl group of 1-6

- carbonatoms; or
phenyl, phenoxy, aryl-alkyl group of 7-12 carbonatoms or aryl-alkoxy group of 7-12
5 carbonatoms each of them optionally containing 1, 2 or 3 same or different
substituents identical to R^1 , R^2 , R^3 or R^4 ; or
two of R^9 , R^{10} , R^{11} , R^{12} , R^{13} and R^{14} mean together an oxo or epoxy group or
further chemical bond or four of them mean together two further chemical bonds and
the remaining groups stand for hydrogen atoms; or
10 R^9 , R^{10} , R^{11} , R^{12} , R^{13} and R^{14} mean together with the chain carbonatoms a saturated
or unsaturated homocycle containing 3-8 carbon atoms or a saturated or unsaturated
heterocycle containing 2-7 carbon atoms and a nitrogen or sulfur or oxygen atom, to
which optionally an aromatic ring of 6-10 carbon atoms is condensed; and
w is zero or 1;
15 C means prolyl group or one of the groups of formula (37), (38), (39), (40) or (41)
- where n is zero or 1 or 2, Hlg means fluorine, chlorine, bromine, or iodine atom;
 R^5 and R^6 mean independently from each other hydrogen atom, hydroxyl group
phenyl group or alkyl group of 1-4 carbonatoms or R^5 and R^6 together mean oxo-
group;
20 R^{16} means an alkoxy group of 1-4 carbon atoms, or -NH- CH_2 -CN group, or -
NH- CH_2 -CO $_2R^7$ group - where R^7 is defined as above; or
D or L structural unit; or one of the group of the formula (42) or (43) or (43a)
- where the dotted line means a chemical bond optionally present-, s is 1, 2 or 3 or
a group of the formula (44) -wherein R^{15} means hydrogen atom, alkyl group of 1-6
25 carbon atoms, phenyl or naphthyl group; or
a group of the formula (45) - wherein Z means NH - group, oxygen atom or sulfur
atom;
D means a covalent chemical bond or prolyl or thioprolyl group, or one of groups of
formula (37) or (38), (39), (40) or (41);
30 L means pyrrolidino- or 2- cyanopyrrolidino, thiazolidino or 2-cyano-thiazolidino or
piperidino group optionally substituted with one halogen atom or geminally with two
halogen atoms; or
a group of the formula (46) - where R^{17} means hydrogen atom or cyano group, n is
0, 1 or 2 ; or
35 a group of the formula (47) or (48) or (49); -

and optical , cis-trans, geometric isomers , epimers, tautomers, salts, prodrugs and human and mammalian metabolites of them.

5

3.) Compounds according to claim 2 - wherein A means a group of the general formula (20a) or (23a) - wherein R means hydrogenatom, alkyl group of 1-4 carbon atoms or aryl or aralkyl group of 6-12 carbon atoms,

10 R^1 , R^2 , R^3 and R^4 mean independently from each other hydrogen atom, halogen atom, hydroxyl group, straight chain or branched chain alkyl or alkenyl- or alkynyl or alkoxy- or alkenyloxy- or alkynyloxy groups containing 1-6 carbon atoms, nitro-group, amino group, monoalkylamino or monoacylamino group of 1-12 carbon atoms ,dialkylamino- or diacylamino group of 2-24 carbon atoms - where the acyl group is an alkyl, aralkyl, cycloalkyl or aryl type -, cyano group, mercapto group, 15 carboxyl group, esterified carboxyl group of 2-7 carbon atoms, hydroxyalkyl group of 1-6 carbon atoms, acyl group of 1-7 carbon atoms, acyloxy group of 1-7 carbon atoms, phenyl or benzyl group, anilino group, benzoyl group, phenoxy group, benzyloxy group, isocyanato group, isothiocyanato group, alkylthio group of 1-6 carbon atoms, sulfamino or sulfamoyl group, thiocyanato or cyanato group;

20 R^5 and R^6 mean independently from each other hydrogen atom, hydroxyl group or phenyl group or alkyl group of 1- 4 carbon atoms or R^5 and R^6 together mean oxo group;

R^7 means alkyl group of 1-6 carbon atoms;

25 R^8 means hydrogen atom or alkyl group of 1-6 carbon atoms or aralkyl group of 7- 10 carbon atoms;

the dotted line means an optional chemical bond;

X means-CH₂-group, -NH-group, carbon atom, hydrogen atom, oxygen atom or amino group;

30 B means $-(CH_2)_m-\overset{\overset{||}{O}}{C}$ -group wherein m is 2 or 3;

C means a prolyl group or a group of the general formula (38) or (41) - wherein n is 1 or 2;

D means a covalent chemical bond; .

35 L means a pyrrolidino or thiazolidino group - and optical, cis-trans, geometric isomers, epimers, tautomers salt produgs and human and mammalian metabolites of them.

4.) Pharmaceutical composition containing one or more compounds of the general formula (I) - wherein the meanings of A, B, C, D, and L are as given in claim 1
5 and 2 - and/or optical, cis-trans, geometric isomers, epimers, tautomers, salts, prodrugs and human and mammalian metabolites of them, alone or together with usual carrier and/or auxiliary materials applied in the pharmaceutical industry.

5.) A process for the preparation of compounds of the general formula (I) - where
10 in the meanings of A, B, C, D, and L are as given in claim 1 and 2 - and optical, cis-trans, geometric isomers, epimers, tautomers and their salts, characterized in that a racemic or optically active carboxylic acid of the general formula (II) - where the meanings of A and B are as given in claim 1 and 2 - is transformed to an acid halide, or an active ester, or to a mixed acid anhydride or to a carbodiimide, and the
15 resulted compound is reacted with a racemic or optically active compound or their salt of the general formula (III), - where the meanings of C, D and L are as given in claim 1 - and the resulted compound of the general formula (I) - where the meanings of A, B, C, D, and L are as given in claim 1 and 2 - optionally is separated into the their optical, cis-trans, geometric isomers, epimers or tautomers or
20 a salt of compounds of general formula (I) is formed, or the compounds of general formula (I) are liberated from their salts.

6.) Use of the compounds of the general formula (I) defined in claim 1 and 2 for inhibition of prolyl-endopeptidase enzyme in mammals including man.

25

7.) Compounds of the general formula (I),- wherein A means one of the groups having general formula (1), (2), (2a), (3), (3a), (4), (5), (6), (7), (8), (9), (10), (11a), (11b), (12), (12a), (13), (13a), (14), (15), (16), (17), (18), (19), (20), (21), (22), (23), (24), (25), (25a), (26), (27), (28), (28a), (29), (30), (31), (32), (32a), (33), (34),
30 (35), (36) - wherein

R means hydrogenatom alkyl group of 1-4 carbon atoms or aryl or aralkyl group of 6-10 carbon atoms,

R¹, R², R³ and R⁴ mean independently from each other hydrogen atom, halogen atom, hydroxyl group, straight chain or branched chain alkyl or alkenyl- or alkynyl
35 or alkoxy- or alkenyloxy- or alkynyloxy groups containing 1-6 carbon atoms, nitro-group, amino group, monoalkylamino or monoacylamino group of 1-12 carbon atoms, dialkylamino- or diacylamino group of 2-24 carbon atoms - where the acyl

- group is an alkyl, aralkyl, cycloalkyl or aryl type -, cyano group, mercapto group, carboxyl group, esterified carboxyl group of 2-7 carbon atoms, hydroxyalkyl group of 1-6 carbon atoms, acyl group of 1-7 carbon atoms, acyloxy group of 1-7 carbon atoms, phenyl or benzyl group, anilino group, benzoyl group, phenoxy group, benzyloxy group, isocyanato group, isothiocyanato group, alkylthio group of 1-6 carbon atoms, sulfamino or sulfamoyl group, thiocyanato or cyanato group;
- R^5 and R^6 mean independently from each other hydrogen atom, hydroxyl group or phenyl group or alkyl group of 1-4 carbon atoms or R^5 and R^6 together mean oxo group;
- R^7 means alkyl group of 1-6 carbon atoms;
- R^8 means hydrogen atom or alkyl group of 1-6 carbon atoms or aralkyl group of 7-10 carbon atoms;
- the dotted line means an optional chemical bond;
- n is zero 1, 2 or 3;
- X means $-CH_2-$ group, $-NH-$ group, carbon atom, hydrogen atom, oxygen atom, amino group; or

- A means an $R'-Y-N=$ group or $R'-Y-N-$ group - wherein R' means alkyl group of 1-6 carbon atoms, aralkyl group of 7-10 carbon atoms, diphenylmethyl group, alkoxy group, arylalkyloxy group of 7-10 carbon atoms, or phenyl- or phenoxy or phenylalkyl group containing 7-10 carbon atoms or phenylalkyloxy group containing 7-10 carbon atoms optionally substituted with halogen atoms or alkyl groups of 1-4 carbon atoms or nitro groups; Y means chemical bond or oxo-, sulfonyl- or sulfinyl group, R^9 means hydrogen atom or alkyl group of 1-4 carbon atoms; - with the proviso that in the case of formulas (20) and (33) X cannot mean $-CH_2-$ group, $-NH-$ group, oxygen atom or sulfur atom and in the case of formulas (30) and (31) X cannot mean $-CH_2-$ group, oxygen atom or sulfur atom or amino group;

30

B means $-(CH_2)_m - \overset{\overset{R^9}{|}}{\underset{\underset{O}{||}}{C}} -$ group - wherein m is an integer of 1 to 21; or

$-O-(CH_2)_p - \overset{\overset{R^9}{|}}{\underset{\underset{O}{||}}{C}} -$ group wherein p is an integer of 1 to 3; or

- 5
$$\begin{array}{c} \text{R}^{12} \left[\begin{array}{c} \text{R}^{13} \\ | \\ -\text{C}- \\ | \\ \text{R}^9 \end{array} \right] \begin{array}{c} \text{R}^{14} \\ | \\ -\text{C}- \\ | \\ \text{R}^{11} \end{array} \text{C}=\text{O} \end{array}$$
 group - wherein $\text{R}^9, \text{R}^{10}, \text{R}^{11}, \text{R}^{12}, \text{R}^{13}$ and R^{14} mean independently from each other hydrogen alkyl or alkoxy group of 1-6 carbonatoms, halogen, amino group optionally substituted with one or two alkyl group of 1-6 carbonatoms; or
- 10 phenyl, phenoxy, aryl-alkyl group of 7-12 carbonatoms or aryl-alkoxy group of 7-12 carbonatoms each of them optionally containing 1, 2 or 3 same or different substituents identical to $\text{R}^1, \text{R}^2, \text{R}^3$ or R^4 ; or
- two of $\text{R}^9, \text{R}^{10}, \text{R}^{11}, \text{R}^{12}, \text{R}^{13}$ and R^{14} mean together an oxo or epoxy group or further chemical bond or four of them mean together two further chemical bonds and the remaining groups stand for hydrogen atoms; or
- 15 $\text{R}^9, \text{R}^{10}, \text{R}^{11}, \text{R}^{12}, \text{R}^{13}$ and R^{14} mean together with the chain carbonatoms a saturated or unsaturated homocycle containing 3-8 carbon atoms or a saturated or unsaturated heterocycle containing 2-7 carbon atoms and a nitrogen or sulfur or oxygen atom, to which optionally an aromatic ring of 6-10 carbon atoms is condensed; and
- w is zero or 1;
- 20 C means prolyl group or one of the groups of formula (37), or (38), (39), (40) or (41) - where n is 0, 1 or 2, Hlg means fluorine, chlorine, bromine, or iodine atom, R^5 and R^6 mean independently from each other hydrogen atom, hydroxyl group phenyl group or alkyl group of 1-4 carbonatoms or R^5 and R^6 together mean oxo-group; R^{16} means an alkoxy group of 1-4 carbon atoms, or $-\text{NH}-\text{CH}_2-\text{CN}$ group, or $-\text{NH}-\text{CH}_2-\text{CO}_2\text{R}^7$ group - where R^7 is defined as above; or
- 25 D or L structural unit or one of the group of the formula (42) or (43) - where the dotted line means a chemical bond optionally present or a group of the formula (44) -wherein R^{15} means hydrogen atom, alkyl group of 1-6 carbon atoms, phenyl or naphthyl group; or
- 30 a group of the formula (45) - wherein Z means NH - group, oxygen atom or sulfur atom;
- D means a covalent chemical bond or prolyl- or thioprolyl group; or one of groups of formula (37) or (38), (39), (40) or (41);
- L means pyrrolidino- or 2- cyanopyrrolidino, thiazolidino or 2-cyano-thiazolidino
- 35 or piperidino group optionally substituted with one halogen atom or geminally with two halogen atoms; or

a group of the formula (46) - where R^{17} means hydrogen atom or cyano group, n is 0, 1 or 2 ; or

5 a group of the formula (47) or (48);

and optical , cis-trans, geometric isomers , epimers, tautomers, salts, prodrugs and human and mammalian metabolites of them.

(Priority: 17 August 1995)

10 8.) Compounds according to claim 7 - wherein

A means a group of the general formula (I) or (9) or (11a) or (11b) or (13) or (22) - wherein R means hydrogenatom alkyl group of 1-4 carbon atoms or aryl or aralkyl group of 6-10 carbon atoms,

15 R^1 , R^2 , R^3 and R^4 mean independently from each other hydrogen atom, halogen atom, hydroxyl group, straight chain or branched chain alkyl or alkenyl- or alkynyl or alkoxy- or alkenyloxy- or alkynyloxy groups containing 1-6 carbon atoms, nitro-group, amino group, monoalkylamino or monoacylamino group of 1-12 carbon atoms, dialkylamino- or diacylamino group of 2-24 carbon atoms - where the acyl group is an alkyl, aralkyl, cycloalkyl or aryl type -, cyano group, mercapto group, 20 carboxyl group, esterified carboxyl group of 2-7 carbon atoms, hydroxyalkyl group of 1-6 carbon atoms, acyl group of 1-7 carbon atoms, acyloxy group of 1-7 carbon atoms, phenyl or benzyl group, anilino group, benzoyl group, phenoxy group, benzyloxy group, isocyanato group, isothiocyanato group, alkylthio group of 1-6 carbon atoms, sulfamino or sulfamoyl group, thiocyanato or cyanato group;

25 R^5 and R^6 mean independently from each other hydrogen atom, hydroxyl group or phenyl group or alkyl group of 1- 4 carbon atoms or R^5 and R^6 together mean oxo group;

R^7 means alkyl group of 1-6 carbon atoms;

30 R^8 means hydrogen atom or alkyl group of 1-6 carbon atoms or aralkyl group of 7-10 carbon atoms;

the dotted line means an optional chemical bond;

n is zero 1, 2 or 3;

X means-CH₂-group, -NH-group, carbon atom, hydrogen atom, oxygen atom, amino group;

35 B means a - (CH₂)_m - $\overset{\text{O}}{\underset{|}{\text{C}}}$ - group - wherein m is 2 or 3;

C means a prolyl group or a group of the general formula (38) or (41) wherein n is 0, 1 or 2;

5 D means a covalent chemical bond;

L means a pyrrolidino group - and optical, cis-trans, geometric isomers, epimers, tautomers, salts produgs and human and mammalian metabolites of them.

(Priority: 17 August 1995)

10 9.) Compounds according to claim 7 - wherein

A means a group of the general formula (1) or (4) or (9) or (11a) or (11b) - wherein

R means hydrogenatom, alkyl group of 1-4 carbon atoms or aryl or aralkyl group of 6-10 carbon atoms,

R¹, R², R³ and R⁴ mean independently from each other hydrogen atom, halogen

15 atom, hydroxyl group, straight chain or branched chain alkyl or alkenyl- or alkynyl or alkoxy- or alkenyloxy- or alkinyloxy groups containing 1-6 carbon atoms, nitro-group, amino group, monoalkylamino or monoacylamino group of 1-12 carbon atoms, dialkylamino- or diacylamino group of 2-24 carbon atoms - where the acyl group is an alkyl, aralkyl, cycloalkyl or aryl type -, cyano group, mercapto group,

20 carboxyl group, esterified carboxyl group of 2-7 carbon atoms, hydroxyalkyl group of 1-6 carbon atoms, acyl group of 1-7 carbon atoms, acyloxy group of 1-7 carbon atoms, phenyl or benzyl group, anilino group, benzoyl group, phenoxy group, benzyloxy group, isocyanato group, isothiocyanato group, alkylthio group of 1-6 carbon atoms, sulfamino or sulfamoyl group, thiocyanato or cyanato group;

25 R⁵ and R⁶ mean independently from each other hydrogen atom, hydroxyl group or phenyl group or alkyl group of 1- 4 carbon atoms or R⁵ and R⁶ together mean oxo group;

R⁷ means alkyl group of 1-6 carbon atoms;

R⁸ means hydrogen atom or alkyl group of 1-6 carbon atoms or aralkyl group of 7- 30 10 carbon atoms;

the dotted line means an optional chemical bond;

n is zero 1, 2 or 3;

X means-CH₂-group, -NH-group, carbon atom, hydrogen atom, oxygen atom, amino group;

35 B means a - (CH₂)_m - C - group - wherein m is 2 or 3;

$$\begin{array}{c} \parallel \\ \text{O} \end{array}$$

C means a prolyl group or a group of the general formula (38) or (41) - wherein n is 0, 1 or 2;

5 D means a covalent chemical bond;

L means a pyrrolidino or thiazolidino group - and optical, cis-trans, geometric isomers, epimers, tautomers, salts prodrugs and human and mammalian metabolites of them.

(Priority: 17 August 1995)

10

10.) Pharmaceutical composition containing one or more compounds of the general formula (I) - wherein the meanings of A, B, C, D and L are as given in claim 7 - and/or optical, cis-trans, geometric isomers, epimers, tautomers, salts and prodrugs and human mammalian metabolites of them, alone or together with usual carrier and/or auxiliary materials applied in the pharmaceutical industry.

15

(Priority: 17 August 1995)

11.) A process for the preparation of compounds of the general formula (I) - where in the meanings of A, B, C, D, and L are as given in claim 7 - and optical, cis-trans, geometric isomers, epimers, tautomers and their salts, characterized in that a racemic or optically active carboxylic acid of the general formula (II) - where the meanings of A and B are as given in claim 7 - is transformed to an acid halide, or an active ester, or to a mixed acid anhydride or to a carbodiimide, and the resulted compound is reacted with a racemic or optically active compound or their salt of the general formula (III), - where the meanings of C, D and L are as given in claim 7 - and the resulted compound of the general formula (I) - where the meanings of A, B, C, D, and L are as given in claim 7 - optionally is separated into their optical, cis-trans, geometric isomers, epimers or tautomers or a salt of compounds of general formula (I) is formed, or the compounds of general formula (I) are liberated from their salts.

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(Priority: 17 August 1995)

12.) A process according to claim 11 characterized in that, an acid addition salt of compound of general formula (III) is used.

(Priority: 17 August 1995)

35

13.) A process according to claim 11 characterized in that, a reactive mixed anhydride is formed starting from a compound of the general formula (II) and

pivaloylchloride is applied.

(Priority: 17 August 1995)

5

14.) A process according to claim 11 characterized in that, the reaction is carried out in an organic solvent.

(Priority: 17 August 1995)

10

15.) A process according to claim 11 characterized in that, the reaction is carried out at a temperature between - 25 °C and the boiling point of the reaction mixture.

(Priority: 17 August 1995)

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16.) A process according to claim 11 characterized in that, the reaction is carried out in the presence of an acid binding agent.

(Priority: 17 August 1995)

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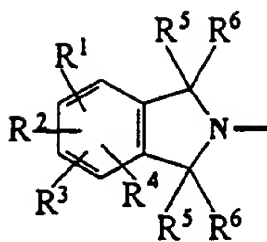
17.) Use of the compounds of the general formula (I) defined in claim 6 for inhibition of prolyl-endopeptidase enzyme in mammals including man.

(Priority: 17 August 1995)

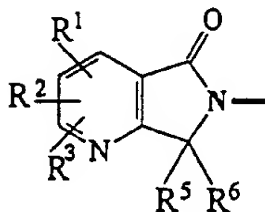
18.) Compounds according to claim 1 or claim 7 substantially as hereinbefore described.

A—B—C—D—L

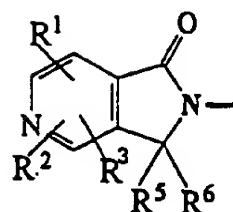
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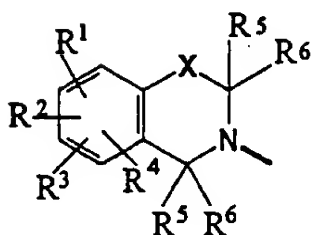
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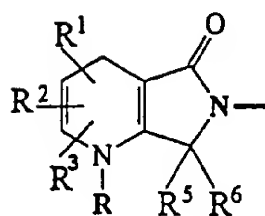
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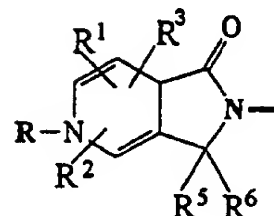
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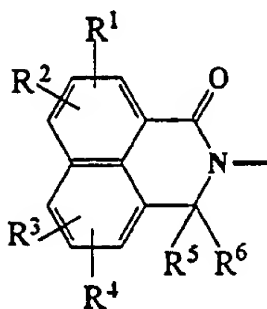
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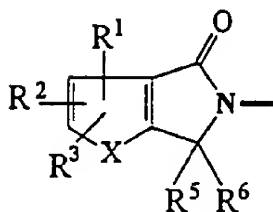
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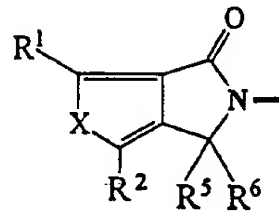
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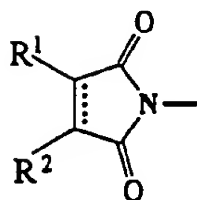
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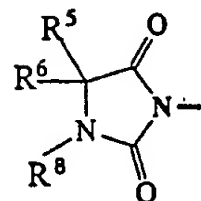
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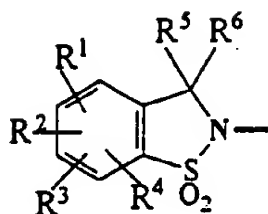
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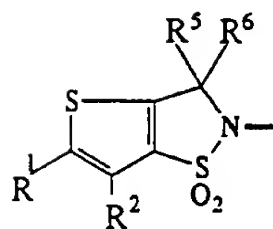
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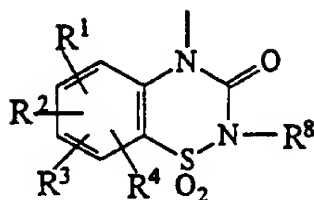
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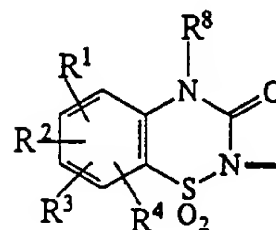
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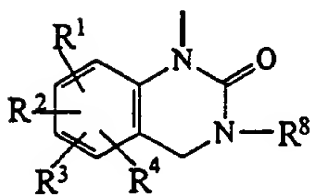
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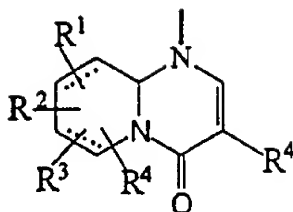
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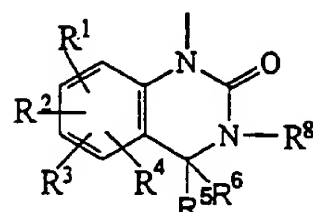
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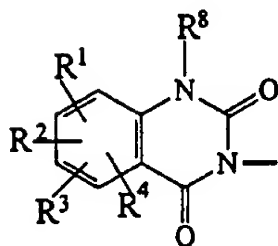
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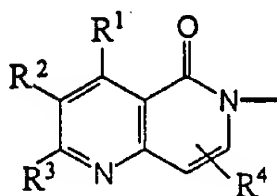
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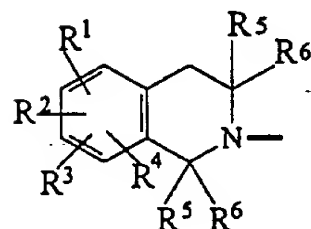
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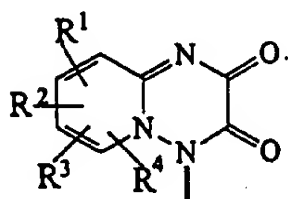
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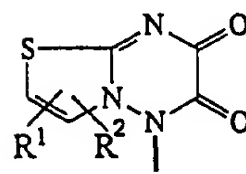
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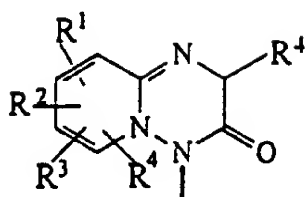
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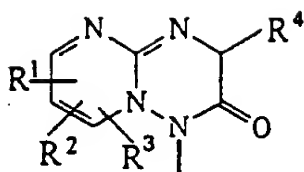
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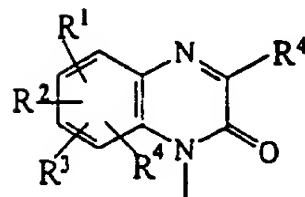
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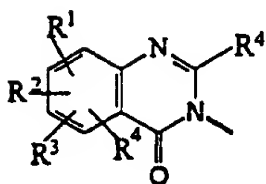
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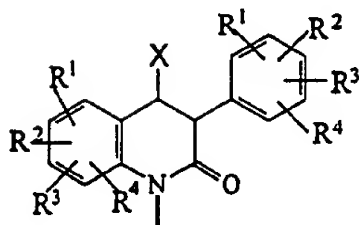
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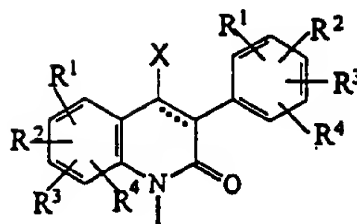
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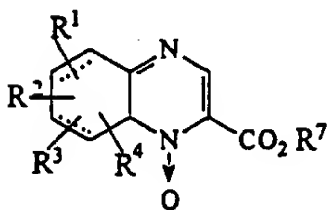
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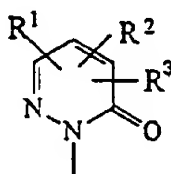
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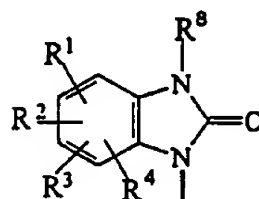
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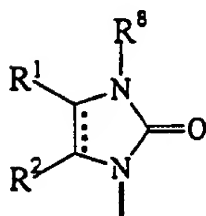
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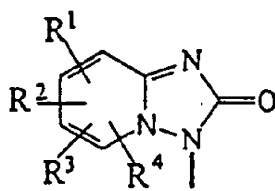
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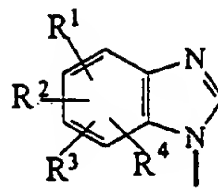
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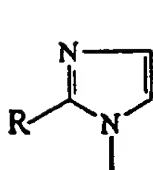
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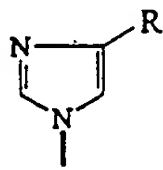
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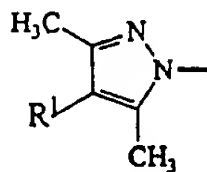
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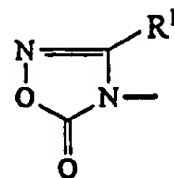
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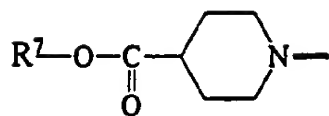
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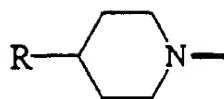
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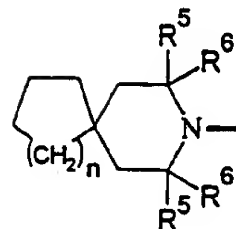
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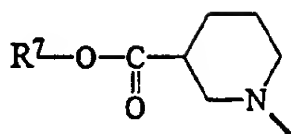
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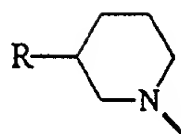
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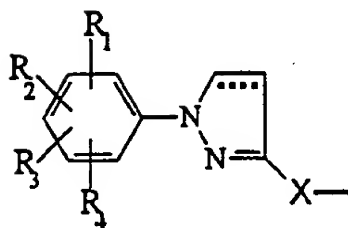
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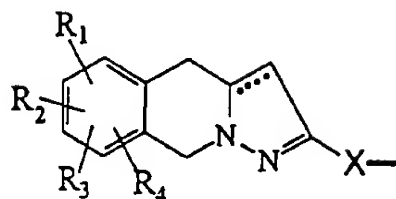
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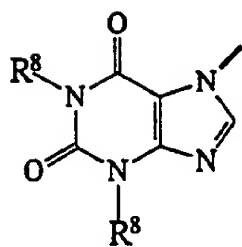
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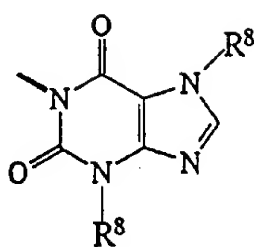
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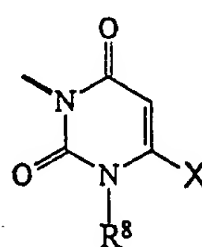
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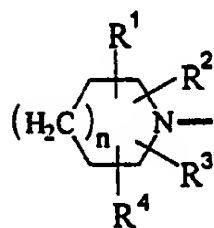
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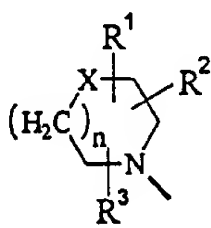
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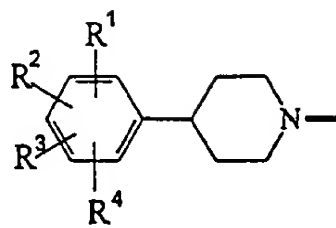
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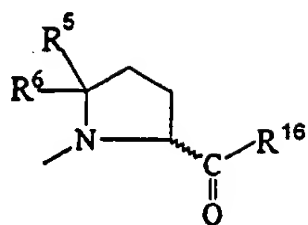
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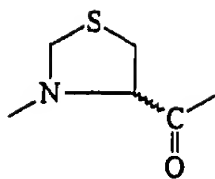
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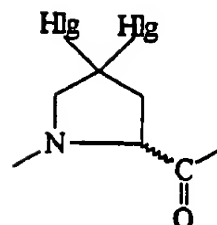
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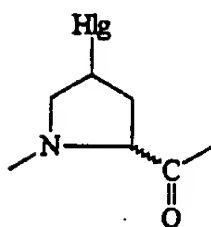
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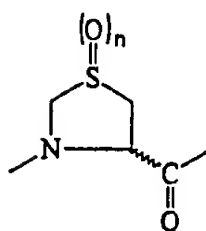
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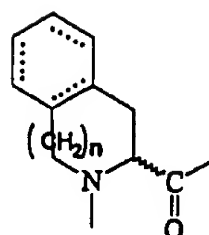
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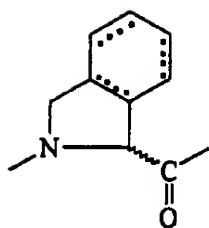
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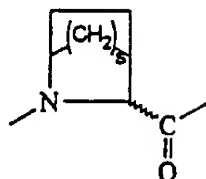
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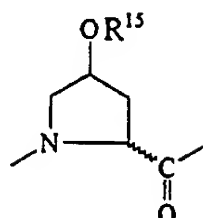
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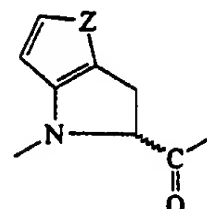
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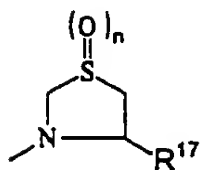
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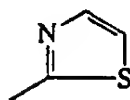
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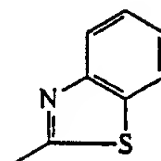
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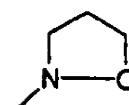
[46]



[47]



[48]



[49]

A—B—OH

[II]

H—CDL

[III]

INTERNATIONAL SEARCH REPORT

International Application No

PCT 96/00041

A. CLASSIFICATION OF SUBJECT MATTER
 IPC 6 C07D403/06 A61K31/33 C07D401/14 C07D417/14 C07D471/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
 IPC 6 C07D A61K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 419 683 A (YOSHITOMI PHARMACEUTICAL INDUSTRIES, LTD.) 3 April 1991 see claims ---	1,4,6
A	EP 0 468 469 A (YOSHITOMI PHARMACEUTICAL INDUSTRIES, LTD.) 29 January 1992 see claims ---	1,4,6
A	EP 0 372 484 A (ZERIA PHARMACEUTICAL CO., LTD.) 13 June 1990 see claims ---	1,4,6
A	JOURNAL OF MEDICINAL CHEMISTRY, vol. 37, no. 13, - 1994 WASHINGTON US, pages 2071-2078, XP002022213 YOSHIKI TANAKA ET AL: "New potent prolyl endopeptidase inhibitors: ..." see tables 1,2 -----	1,4,6

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

*** Special categories of cited documents :**

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "A" document member of the same patent family

Date of the actual completion of the international search

7 January 1997

Date of mailing of the international search report

17.01.1997

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
 NL - 2280 HV Rijswijk
 Tel. (+ 31-70) 340-2040, Tx. 31 651 epo nl,
 Fax: (+ 31-70) 340-3016

Authorized officer

Van Bijlen, H

INTERNATIONAL SEARCH REPORT

International Application No.

PCT/HU/93/00041

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
Please see attached sheet ./.

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/

The vast number of theoretically conceivable compounds comprised under formula (I) of claim 1 precludes a comprehensive documentary search. Similarly the absence of (a) relevant fixed fragment(s) in the general formula (I) precludes a comprehensive on line search in a structure data base and would not be economically justified (cf. Arts. 8, 15 and Rule 33 PCT; see Guidelines B III 2.1).

INTERNATIONAL SEARCH REPORT

information on patent family members

International Publication No

PCT/HU 00041

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP-A-419683	03-04-91	WO-A- 9012005 US-A- 5118811	18-10-90 02-06-92
EP-A-468469	29-01-92	CA-A- 2048010 JP-A- 5025125 JP-B- 7108897 US-A- 5506256	28-01-92 02-02-93 22-11-95 09-04-96
EP-A-372484	13-06-90	JP-A- 2262557 JP-B- 8022847 AT-T- 113279 AU-B- 616824 AU-A- 4591489 CA-A- 2004028 DE-D- 68919054 DE-T- 68919054 ES-T- 2065975 US-A- 5028604	25-10-90 06-03-96 15-11-94 07-11-91 14-06-90 08-06-90 01-12-94 11-05-95 01-03-95 02-07-91